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MARCH/APRIL 2003

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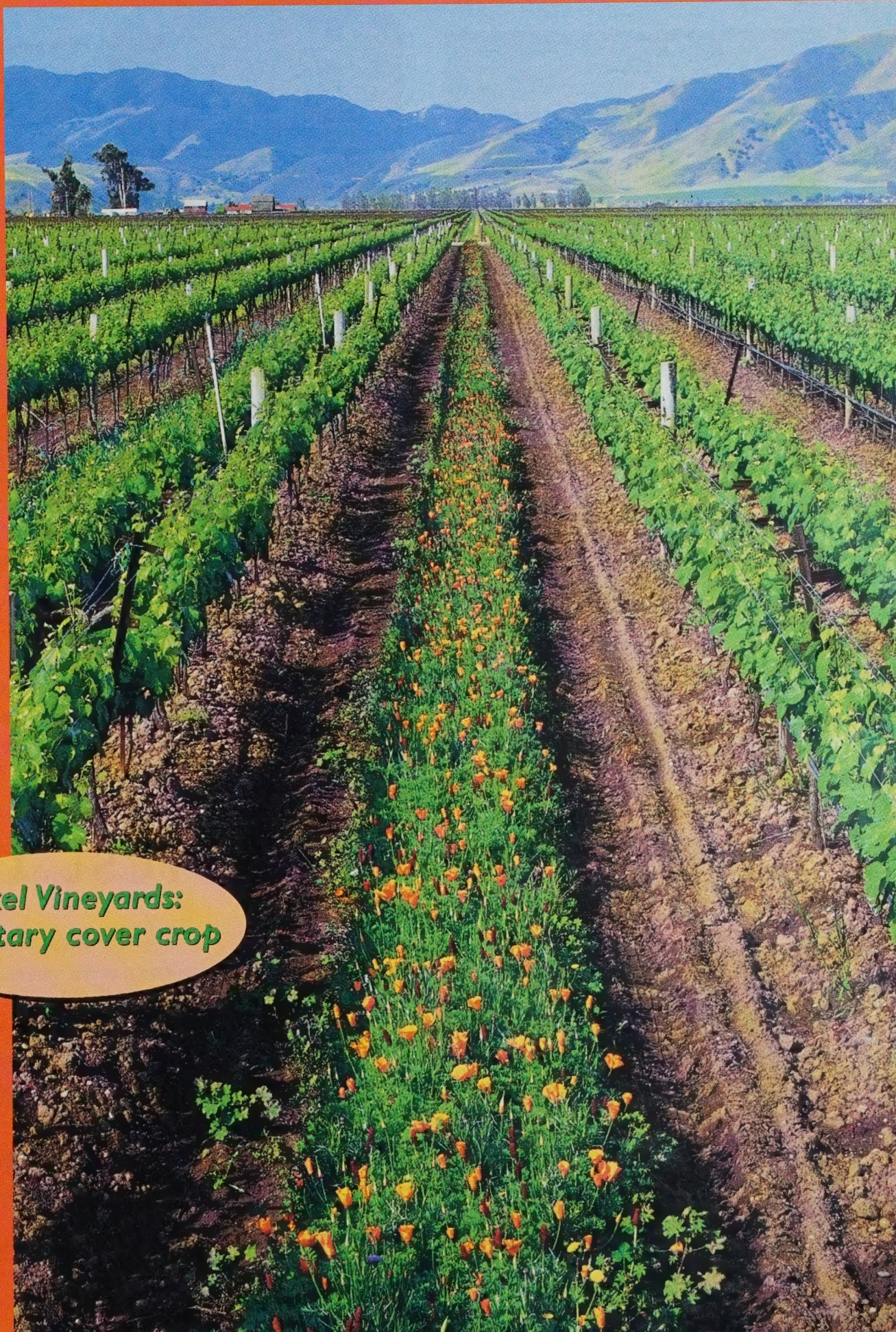
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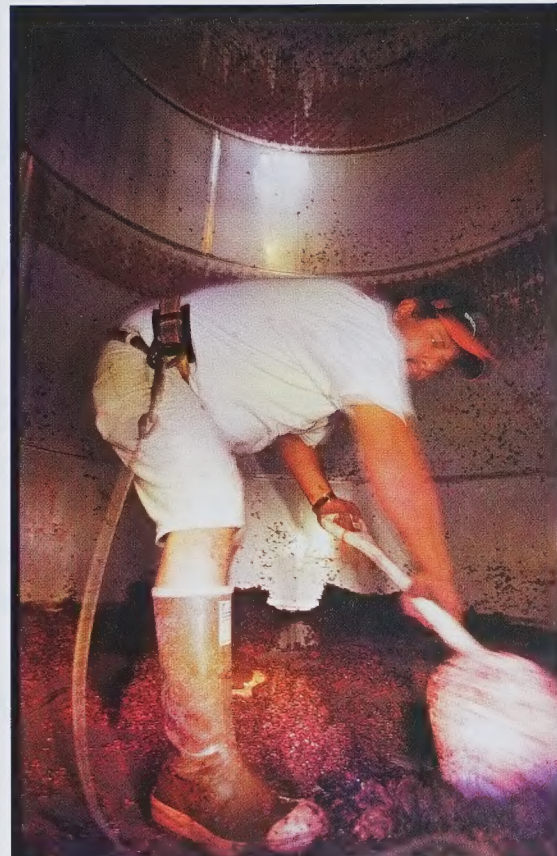
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\$31/year. Outside the
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MARCH/APRIL 2003 • VOL. XXIV, NO. 6

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Welcome to hard times

by Jake Lorenzo

Editor's note: Jake Lorenzo's "In the Cellar" usually appears in the back of PWV, but since the author addresses a number of issues directly related to the health of the wine industry, it appears here as "Free Run," which serves as PWV's forum for industry analyses and opinions. PWV welcomes reader response.

On the home front

Jake Lorenzo is a private eye. Private eyes hate surprises. We're supposed to know stuff. We're not supposed to get surprised. But when you build your own house, there are always surprises.

The first surprise is when you finish the house, move in, and then realize there are no window coverings. This is no big deal when you are a wealthy winery owner living behind hand-wrought mechanical gates on your multi-acre homestead. But in Jake Lorenzo's neighborhood, where houses are shoe-horned together tighter than blow-out Chardonnays on the local grocery shelf, it gets dicey.

Jakelyn's mother was fuming, that's for sure. Shades, drapes, and curtains are all things Jake Lorenzo took for granted until he had to buy them. Damn things are expensive, and you don't even know you need them until all the money is gone paying for incidentals like lumber, plumbing, windows, and drywall.

Anyway, you shop around, take a few extra jobs, and bit by bit the windows get covered. You expand your privacy. You get a respite from the abuse from your female partner, who evidently expects window coverings even before there is a house design.

The windows get covered. You light a roaring fire in the new fireplace. You sit down with a nice glass of wine. You open the day's mail. That's when you get hit with the second surprise... property tax. Until now, Jake Lorenzo has been a life-

long renter. He had no idea about property tax, let alone supplemental tax, interim tax, whimsical tax, and just-one-more-tax.

Jake Lorenzo can sense you smirking. You're thinking, "What a schmuck. The great wine detective doesn't even cover his windows, and he's never paid property tax. Welcome to the real world, Mr. Detective."

Don't misunderstand. Jake Lorenzo is not asking for sympathy. One way or another I'll come up with King George's tithe. It's just that all these financial challenges reveal a great truth of human nature. No one gives a damn about your petty troubles. They are too busy worrying about their own.

The big picture

Back in the late 1970s and early 1980s when the California wine business really took off, it was people who had a love affair with wine who made it happen. Salesmen, bored with selling the differences between Seagram's 7 Crown and Canadian Club, reveled in selling the differences between Napa, Sonoma, and Mendocino.

Retailers, who for years had been searching among low-end foreign wines for something with a hint of fruit, fell in love with those California fruit monsters, most of which were under \$10.

Consumers, most of whom knew nothing of wine, jumped on the bandwagon, took classes, went to tastings, and bought case after case of their favorite brands.

California wine boomed, and the great thing about it was that everyone worked together to make it happen. Winemakers spent time talking to retailers and their clerks, to restaurateurs and their waiters. We were all in this thing together. Friendships were forged. Loyalty was in abundance.

When the boom of the 1990s came, the whole thing stratified. It wasn't enough to sell all of your wine for a

neat little profit. Wine had to be sold in the right restaurants to the important people for top dollar. Tightening allocations meant that many loyal retailers who had supported wineries for years were cut off, since marketing directors decided it was more important to be on a list at Restaurant Chi Chi than on the shelf at Joe's Neighborhood Wine Shop.

Greed set in, prices skyrocketed, and those consumers who had made wine a part of their daily lives — just as we had taught them — could no longer afford our wine. They started looking for values from the Rhône, Italy, and South America, and they found great wines for reasonable prices.

So, as you sit there planning your strategy for the new year, as you consider how to expand your sales in a shrinking market, as you decide to call upon all of your loyal friends to help you through the hard times: don't expect to get a call back. No one gives a damn about your petty troubles. They are too busy worrying about their own.

There is only one way to succeed in business, even in America, the land of opportunity. If you want to be successful, you've got to do the work. The glut of grapes will be with us for years. Take advantage of it. Buy good grapes at low prices and produce delicious wines that sell at attractive prices.

Get out there and press the flesh. Reconnect with retailers and their clerks, with restaurateurs, and their waiters. Get out of Restaurant ChiChi and start spending time in the neighborhood joints.

Realize that people are trying to survive out there. Take the monies you've allocated for entertainment, in-house parties, and sales trips, and spend it where it will do some good.

Start showing up regularly at smaller restaurants that serve great food at reasonable prices. Have everyone who works at your winery go out to dinner, spend some money and leave their cards. Once restaurateurs realize you've been supporting them, present them with delicious wines that they can sell at prices their customers can afford.

FREE RUN

Don't give cash incentives to salespeople. Give them restaurant vouchers to eat at local restaurants on your dime. Make sure the salesmen and the restaurants know who's picking up the tab. They will appreciate it.

Stop giving the one-case on five-case discount to your retailers. Give them restaurant vouchers. Hell, retailers have to eat, too. They will show their apprecia-

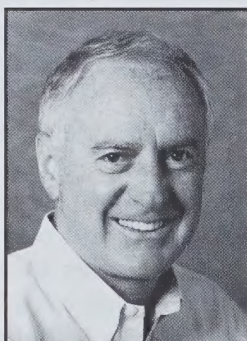
tion by purchasing your wines. You will jump-start your own wine economy.

The California wine business has just finished the longest extended up-cycle of its entire history. Don't pretend the money is gone. In hard times, the people who continue to spend money are heroes.

Get out there and spend some money where it will do the most good: at the neighborhood restaurants owned by

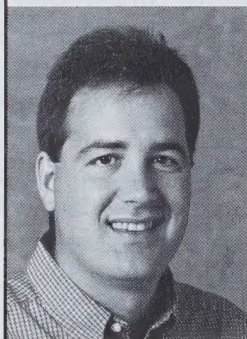
hardworking people offering good value. Associate your wines with the local treasured restaurants, and the locals will come to treasure your wines.

It seems obvious to Jake Lorenzo. If you live in a desert, water is hard to come by. But we live in America, the richest country in the history of the planet. All we need to do is prime the pump. ■

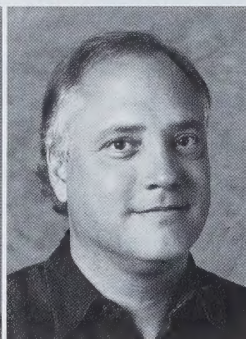


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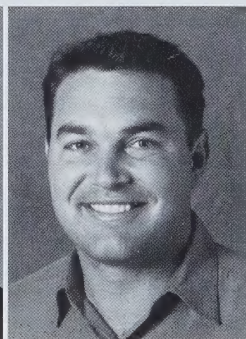
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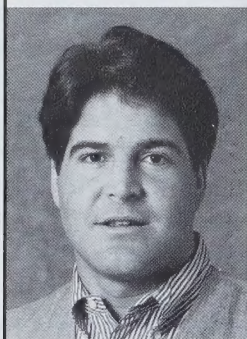
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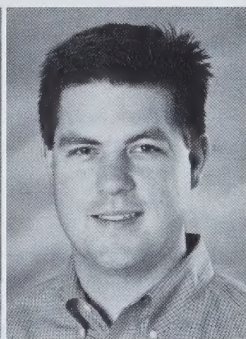
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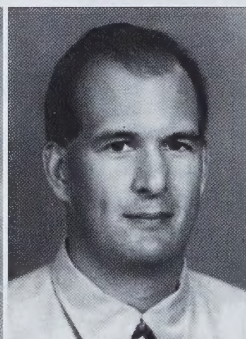
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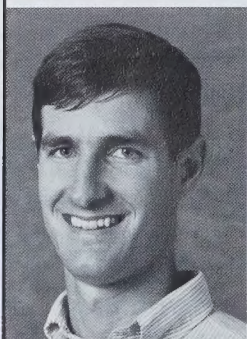
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RESEARCH EFFORT SURVEY

Grappling with mealybugs in California vineyards

BY Craig Macmillan
 Biologically Integrated Farming
 Systems Project Coordinator,
 Central Coast Vineyard Team,
 Kris O'Connor, M.S.
 Principal Investigator,
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Mealybugs are a significant pest on both table and winegrapes in California. The California Department of Food and Agriculture Biological Control Program, University of California, American Vineyard Foundation, and the California Table Grape Commission are all funding ongoing research to evaluate and improve biological control of mealybugs.

This is important work for grapegrowers because, in many cases, very toxic pesticides are used to control mealybugs in vineyards. Most pesticides currently available for treating mealybugs are Food Quality Protection Act Priority I materials, that must be re-registered with the Environmental Protection Agency due to recent scientific research regarding their toxicity.

There are no alternatives for these materials except Imidacloprid.⁵ For growers to increase their commitment to IPM strategies for reducing the use of these materials, it is vital that they show improvements in biological control strategies including better ant control, identification and assessment of new parasites, and quick, effective monitoring.⁵

There are six mealybug species that are current or potential economic threats to California vineyards.¹² Grape mealybug (*Pseudococcus maritimus*), obscure mealybug (*Pseudococcus viburni*), long-tailed mealybug (*Pseudococcus longispinus*), and vine mealybug (*Planococcus ficus*) currently cause significant vineyard damage.^{8,12}

Citrus mealybug (*Planococcus citri*) and pink hibiscus mealybug (*Maconell-icoccus hirsutus*) are not commonly found in vineyards, but could become serious pests if allowed to establish in new areas of California.^{12,18} Mealybugs cause physical and aesthetic damage to grapes by excreting a honeydew that encourages sooty mold and damages grape clusters.¹²

Mealybug species

Correctly identifying the mealybug species infesting a vineyard is important for effective integrated pest management. Identifying the species affects the decisions regarding biological control, pesticide selection, and timing of application.

Grape mealybug is the most widespread species found in California vineyards.¹² It spread dramatically through San Joaquin Valley table grape vineyards during the 1980s and 1990s.¹⁰

Obscure and longtailed mealybugs are found in cooler areas and have been confined to the northern and Central Coast regions.¹² Obscure mealybug was first identified as a species separate from grape mealybug in the 1980s.⁸ The occurrence of both species is closely associated with the presence of Argentine ants.¹⁰

Vine mealybug is a recent arrival to California, first identified in the Coachella Valley in 1994.^{1,16,17} Since then, new infestations have been found in the northern San Joaquin Valley (1998), Central Coast (2000, 2001),¹² and in Sacramento, Napa, Sonoma, and Yolo counties during the fall of 2002.¹⁶

Vine mealybug is difficult to detect and treat because it lives on all parts of the vine, including the roots.^{1,3,17} Damage from this species is excessive because vine mealybugs produce dramatically more honeydew than the other species.^{1,3,12,17} Icicles of honeydew can form, resulting in devastating sooty mold infections.^{1,3,17} Also, vine mealybugs

reproduce at a faster rate than other species — five to seven generations per year compared with two or three generations for obscure and grape mealybugs.¹⁸

Because a vine mealybug spends so much time on the roots of vines, it is difficult to find with field scouting until levels of damage from sooty mold and honeydew are significant. Dr. Jocelyn Millar (UC Riverside) isolated and produced the female sex pheromone of the vine mealybug to attract the winged males to a trap for improved monitoring.^{4,15} This new technique will make it possible to catch vine mealybug infestation early, increasing the chances of successful eradication.^{4,15} Traps should be set in the late winter to catch flying males in the spring. Contact your local farm advisor to obtain vine mealybug pheromone traps.² Commercial versions of the pheromone trap are also scheduled to be available early in 2003.²

Vine mealybugs are spread easily as eggs, crawlers, and adults on vineyard equipment, workers' clothes, and by natural forces like birds and wind.¹ Growers should not move equipment or crews from infested vineyards into clean vineyards.^{1,17} Equipment that must be moved should be steam-cleaned with a long interval before entering the clean vineyard.^{1,17} Do not take cuttings from vineyards that are suspected of being infested with vine mealybug.^{1,17}

Ant control

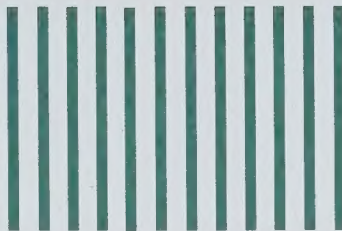
Argentine ant is a common species of ant associated with mealybug infestations. In 1891, Argentine ants were first reported as a pest in New Orleans, LA.¹⁹ By 1908, they had spread throughout California.¹⁹ The ants tend the mealybugs to collect sweet honeydew as a food source, and they actively interfere with natural parasites.^{6,7,12,19} Levels of parasitism can be as high as 90% for many parasitoids when ants are not present or significantly reduced in activity.^{6,7,12}

Traditionally, ants have been controlled with limited success by applying Lorsban or Diazanon after harvest. Direct applications of strong, broad spectrum organophosphates are effective at killing foraging workers on vines, but do not kill larvae in the nest.^{7,19}

Research by Michael Rust and John Klotz shows success at reducing Argentine ant activity by using minute amounts of pesticide in sucrose solution delivered from a bait station.^{6,7,19} Bait sta-



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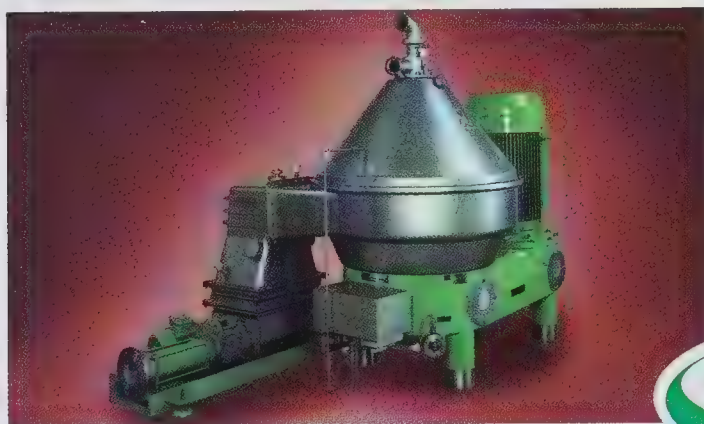
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tions of various types have been placed in vineyard sites where mealybug parasites were released.^{6,7} The bait stations contain a 25% sucrose solution with a 0.001 to 0.0001% addition of Thiomethoxam, Fipronil, or Imidacloprid.^{6,7} Thiomethoxam and Fipronil were demonstrated in the work of Rust and Klotz to be very effective materials for controlling Argentine ants.^{7,19}

Thiomethoxam and Fipronil are not registered with the EPA for use on grapes. Use of these materials is being conducted under University of California research permits. Although the use of bait stations containing Thiomethoxam or Fipronil is encouraging, this is still an experimental technique under scientific investigation that may be several years away from commercial application.²

Biological control research

Arthropod predators of mealybugs on grapes have been observed, but not extensively studied for efficacy.^{8,10} They include spiders, predaceous flies

(*Dicrodiplosis californica*), green lacewings (*Chrysoperla* spp.), brown lacewings (*Hemerobius* spp.), minute pirate bug (*Orius* spp.), and the Mealybug Destroyer (*Cryptolaemus montrouzieri*) which has been reported as a significant biological control agent for mealybugs in the former Soviet Union.^{8,10,12}

Several parasite species have shown success at reducing mealybug populations and associated crop damage.^{6,7,10,12} All of these parasites are wasps, and like other parasitoid wasp species, the female is adapted to lay eggs in a mealybug host.⁹ The host dies during maturation of the parasite egg.⁹ Limitations to parasitoid success are the interference of Argentine ants and the fact that parasites are specific to only one or two mealybug species.^{4,5,6,8,9,10} None of these wasps have common names.

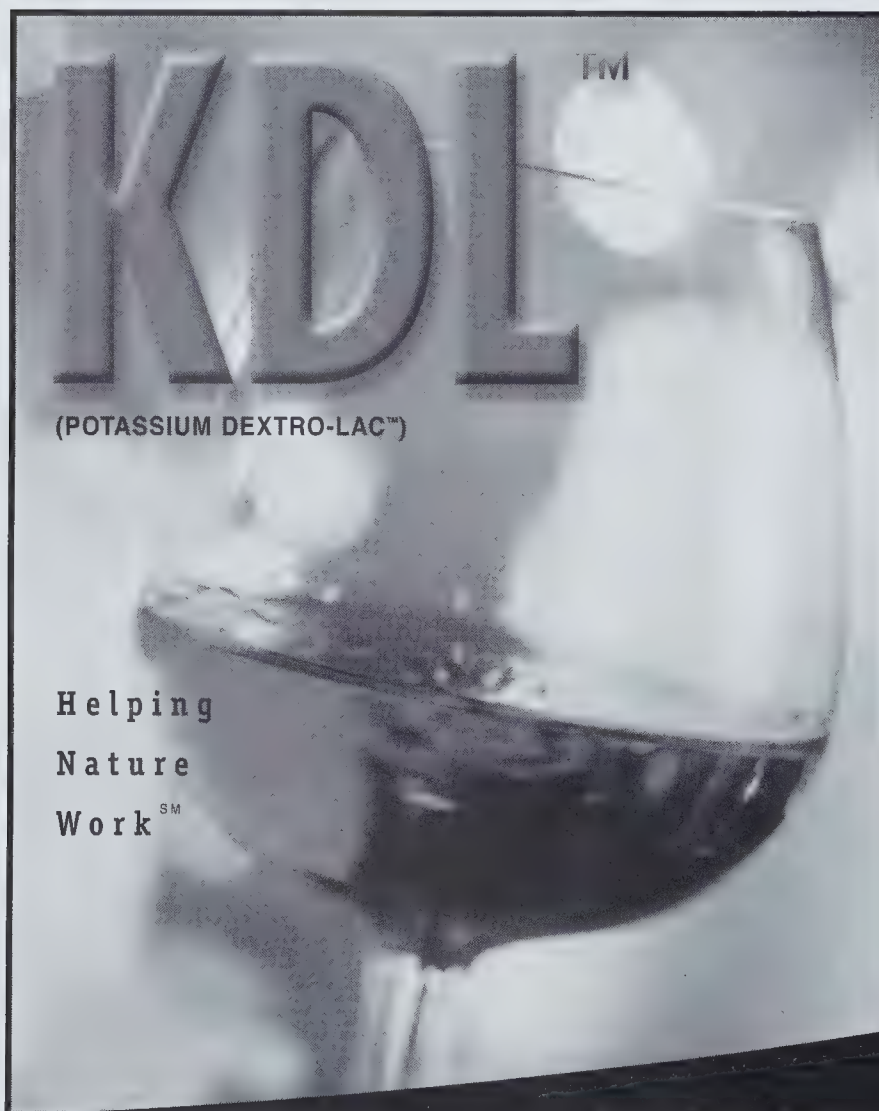
Acerophagus notativentris was identified as a parasite of grape mealybugs as early as the 1920s.⁸ *A. notativentris* is active in the spring, with parasitism rates as high as 80% reported in early

studies. However, recent studies indicate that there is more variation in rates of parasitism (as low as 11%) and more parasitoid species playing a role.¹⁰

Pseudaphycus angelicus is another parasite of grape mealybugs that also parasitizes long-tailed mealybugs, making it especially attractive for rearing in insectaries because most wasps will parasitize only one species of insect. *P. angelicus* is currently being reared at the University of California Berkeley Insectary and Quarantine Facility.

Releases of *P. angelicus* were made in 2000 at study sites in Delano and Napa by Dr. Kent Daane.⁷ *P. angelicus* was also released in 2002 in Santa Maria Valley as part of the Central Coast Vineyard Team's Biologically Integrated Farming Systems Project, also under Daane's direction.

Pseudaphycus flavidulus and *Leptomastix epona* are parasites of obscure mealybug. Both species were released for study in Napa, San Luis Obispo, and Santa Barbara counties in 1999.⁶



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Leptomastix epona appears to be more difficult to rear than *P. flavidulus*.⁶

Mid-season releases of parasites have not shown dramatic reductions in mealybug populations during the same season, but Daane's research indicates that both *P. angelicus* and *P. flavidulus* spread quickly from release sites and can significantly reduce the economic damage of mealybugs when Argentine ant populations are controlled.^{6,7} At one study site where *P. flavidulus* was released and Argentine ant activity was low, the rate of parasitism exceeded 75%. But at other sites where Argentine ants were active, parasitism was less than 25%.⁶

Leptomastidea abnormis and *Anagyrus pseudococci* are parasites of the vine mealybug.^{1,12,13,14,15,17} *A. pseudococci* was first introduced into California in the 1940s for control of citrus mealybug.^{12,15} *L. abnormis* and a new strain of *A. pseudococci* were introduced into the San Joaquin Valley in the late 1990s.^{12,13,15} Both of these parasites have

shown some efficacy at reducing vine mealybug populations.¹⁵

A. pseudococci is active in the spring and early summer, whereas *L. abnormis* becomes active a few months later.¹⁵ Both species are important for a biological control approach to vine mealybug.¹⁵ The key to parasite success on vine mealybug appears to be the amount of time mealybugs are exposed during the growing season. In the San Joaquin Valley, parasitism rates as high as 80% were observed.¹⁵ By contrast, in the Coachella Valley, parasitism rates never exceeded 25%.¹⁵ This may be due to vine mealybugs taking refuge on vine roots from the excessive heat of the Coachella summer, making it impossible for parasites to find them.¹⁵

Monitoring and treatment

One way to reduce pesticide use is to carefully identify areas of mealybug infestation and treat only those areas rather than the entire block.¹⁰ Recent

investigations of monitoring techniques suggest the following monitoring guidelines for all mealybug species in all regions of California.^{1,3,4,10,12}

- Train field personnel to mark the worst mealybug infestations and keep records to monitor those hot spots in the future.

- Check for mealybug crawlers near pruning wounds on warm spring days before bud break.

- Treat with Lorsban (4 pints in 200 gallons per acre water) at this time to knock down the first generation.⁴

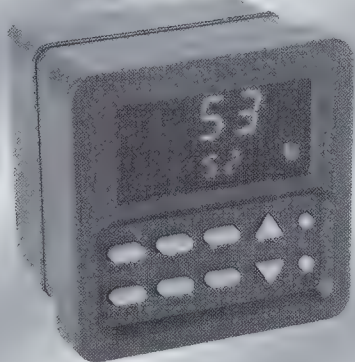
- Map infestation at this time to focus monitoring later in season.

- Monitor for mealybugs in known hot spots with timed searches mid-season (set to bunch closure). If parasitoid mummies are found, consider not spraying.

- With mid-season monitoring, spot treat in areas where damage appears likely.

- Map cluster damage at harvest. Use these as guidelines to monitor hot spots in spring.

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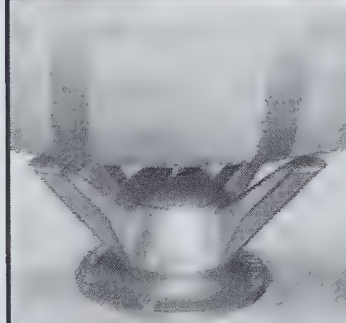
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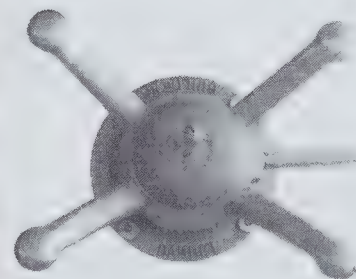
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A number of sampling techniques for evaluating mealybug infestations were compared by Geiger and Daane.¹¹ These techniques included sticky trap barriers on canes, examining standard size bark strips removed from trunks, excised spur samples, non-destructive spur counts, and timed searches. Each

technique was compared to others and to an absolute count from a complete destructive sampling of a vine with microscopic laboratory examination.¹¹

Timed counts proved to be the best technique for predicting damage to fruit at harvest.¹¹ Searching all parts of the vine for five minutes to count all

mealybugs proved best, but a three-minute search was satisfactory.^{10,11} This can be a costly technique if one considers the amount of time required to perform even a three-minute per vine search on a representative number of vines in a vineyard. Even with hours of sampling in the field, it is still possible to miss infestations.^{10,11}

To address this difficulty, the Central Coast Vineyard Team's Biologically Integrated Farming Systems (BIFS) Project developed a "Mealybug Index" for collecting data at BIFS project sites. It was also an attempt to reduce the cost of the Geiger/Daane method. Rather than searching the vine for a set period of time, a quick examination is made from the base of the trunk, up and out the cordon, up into the canopy, and into grape clusters.

In lieu of a population count, a rating of 0 to 5 is given, depending on the lifestage and location of the mealybugs. 0 means no evidence of mealybugs; 1 means some wax or honeydew was found; 2 means at least one adult was found; 3 means eggs were found; 4 means at least one crawler was found; and 5 means at least one crawler was found on at least one cluster. This technique can be used for all species of mealybugs, although extra effort should be made to search near the roots of vines where vine mealybug is the pest.

This technique requires further study, but was used by some BIFS growers for locating hot spots and making treatment decisions during the 2002 season. Future efforts will evaluate this method for predicting crop damage and developing treatment thresholds.

Mapping cluster damage at harvest is important for adjusting the following season's monitoring and treatment decisions.^{10,11} Daane developed a 0 to 3 scale for evaluating cluster damage. 0 indicates no damage; 1 means there is some honeydew, but the cluster is salvageable; 2 means honeydew and mealybugs are present, but the cluster is salvageable; and 3 means the cluster is a total loss.^{10,11} This technique was used by the CCVT BIFS Project in 2002, sampling nine clusters per vine — three each from the left, center, and right areas of the fruit zone — on 16 vines per block (1.9 to 11 acres). Damage was low (an average of 1 or below) at all sites rated. Spring time monitoring in 2003 for mealybugs at CCVT BIFS sites will be focused on areas

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where damage was found at harvest in 2002.

Conclusions

- Be alert for mealybug infestations.
- Identify the species of mealybug when found.
- Monitor and map ongoing mealybug infestation to better target location and timing of pesticide applications.
- Biological control won't eradicate the pest, but it can reduce the economic damage.
- Ant control through the use of bait stations can improve the success of biological controls, but the technique is still experimental.

For more information and help with identification, obtain the pamphlet: "Mealybugs in California Vineyards," Godfrey, K. E.; Daane, K. M.; Bentley, W. J.; Gill, R. J.; Malakar-Kuenen, R. 2002. University of California Agriculture and Natural

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Continued on page 56

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Strategies to control powdery mildew

BY Wayne F. Wilcox, Professor
Department of Plant Pathology
NY State Agricultural Experiment Station
Cornell University, Geneva, NY

Powdery mildew (PM) afflicts vineyards worldwide. Eastern North America has the dubious distinction of being home to this disease, and we cannot grow grapes here without controlling it. Although our climate is different from that in the western U.S., the fungus responds similarly to environmental factors and control treatments in both areas. While certain management details may vary among regions, all control programs employ the same basic principles. Within this context, I'd like to discuss:

- The fundamental biology of the disease;
- When the crop is most susceptible to infection;
- The basics of the fungicides that are used in control programs.

Biology

The PM fungus overwinters either within infected buds, which germinate to form mildewed "flag shoots" in the spring; or as minute fruiting bodies (cleistothecia) that lodge in the bark on the vine. They then release unique spores (ascospores) to infect new foliage and young clusters in the spring. The subsequent spores (conidia) produced on infected tissues are the same as those produced on flag shoots, so further spread throughout the season is the same regardless of the initial source of infection. Of course, any program that provides good disease control on the

fruit and foliage during one growing season will limit the production of both cleistothecia and flag shoots that perpetuate PM the following spring.

Although cleistothecia do require at least a brief rain to release their ascospores, neither these spores nor the conidia require moisture in order to germinate and cause infection. Therefore, the primary factor that controls the spread of PM is temperature. Table I summarizes work conducted at the University of California, Davis, in the 1950s, showing the number of days from the time that a spore lands on a leaf until it forms a mildew colony producing new spores capable of disease spread.

Table I – Effect of temperature on spread of powdery mildew

Temp. (°F) ^a	Days
48	25
54	18
59	11
63	7
74–86	5–6
90	not active

^a Constant temperatures

These data are extremely useful in formulating spray strategies, and are the "guts" of the current UC Davis risk index that has been used so effectively in California over the last few years. Note that whereas the fungus can multiply rapidly when temperatures are in the mid-60s to mid-80s, it is inactive while temperatures remain above 90°F. In fact, some spores and colonies are

Photo: Symptoms of severe powdery mildew on berries, leaves, and shoots of Cabernet Sauvignon.

killed after relatively short exposures above 95°F, a fact that also is accounted for by the risk index.

Another environmental factor that influences development of PM is relative humidity (RH), although just how important a role it plays remains unclear. In multiple tests on Riesling seedlings, we've shown that disease severity increases progressively to a point of doubling as the RH increases from 39% (the lowest level that could be tested) up to an optimum near 85% to 90%. (Rain or condensation on the leaves and fruit are detrimental to disease development).

A model that guides control programs in German vineyards incorporates humidity as one of its determining factors, and recent work at UC Davis has provided further evidence that humidity affects the development of this disease. Although not as influential as temperature, higher humidities do increase the risk of PM. Thus, coastal regions appear to face a "double whammy," with both temperature and humidity remaining highly favorable for PM throughout much of the season.

Crop susceptibility

Powdery mildew is a disease of young, juvenile tissues. Leaves are highly susceptible to infection while they are expanding, but become resistant soon after they're fully expanded. Similarly, recent research by colleagues at Cornell has shown that berries are



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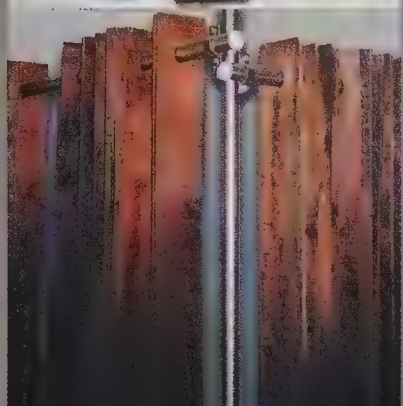
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highly susceptible from bloom until shortly after fruit set, but become much more resistant afterwards.

Although fruit on very susceptible varieties, such as Chardonnay, may not become highly resistant until more than five weeks after bloom (much earlier than previous literature has indi-

cated), severe berry infections appear to develop *only* when they are initiated during the first few weeks after flowers open. Emphasizing this point, repeated fungicide trials have demonstrated that sprays applied from the start of bloom until two or three weeks later are responsible for the lion's share of

PM control on the berries. Conversely, significant berry infection at harvest can almost always be traced back to a problem with the control program during this early post-bloom period.

Now for the fine print:

1) In climates such as that of the northeastern U.S., most flowers tend to open within a few days of each other. "Bloom" is relatively easy to define, as are the specific times when berries are highly susceptible to infection and when they start to acquire significant resistance. However, in climates such as that of California, particularly in certain locations and/or years, flowers may open over a much longer period of time, resulting in some berries acquiring age-related resistance at a time when others are still young and highly susceptible. This can extend the "danger period" in any given vineyard.

2) In the northeastern U.S. climate, infections that occur about four weeks post-bloom (near bunch closure, when berries are in their final stage of susceptibility) produce few visible symptoms. However, such infections are visible with magnification, and appear to provide an entry point for bunch rot and other spoilage microorganisms.

The message is simple: Unless temperatures are consistently high enough to shut down the disease, *the critical time to control PM on the fruit is from the start of bloom until a few weeks later*. The key is to maintain good protection through bunch closure. Although this is certainly not the only time to spray for PM, it is when you should use your best PM fungicides and do the best possible job of applying them. There will be times when you need to take shortcuts in various operations during the season, but don't shortcut your disease control program during this critical period.

Fungicides

Sulfur is a traditional material with two major positives: it's cheap and effective. Furthermore, it's been used to control PM around the world for nearly 150 years, with no development of resistance. However, because sulfur acts largely through the vapor phase, its activity is temperature-sensitive. Conventional wisdom says that sulfur is relatively inactive at cool temps below 65°F, and can be phytotoxic at temperatures above 85° to 90°F. Although sulfur products have been used effectively under such "subopti-

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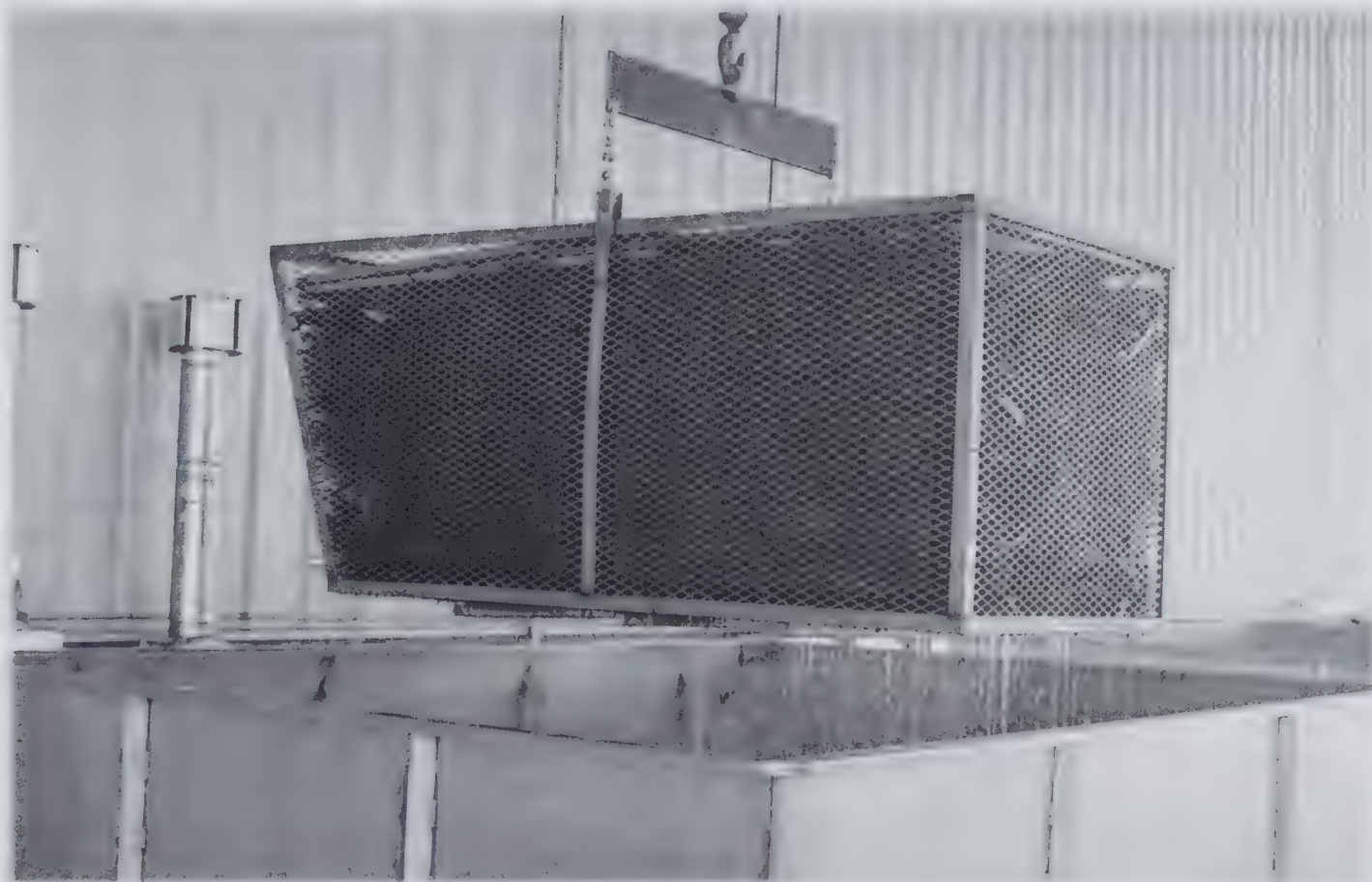
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mal" conditions, these potential limitations should be recognized.

DMI fungicides do not inhibit spore germination, but attack the fungus during its early growth stage within the plant. Thus, they provide only limited residual or protective activity, but do provide significant post-infection activity. This probably explains why they were once so effective under extended spray intervals; that is, when new (unprotected) leaves developed after one spray and became infected, control was provided by the post-infection activity of the next spray. However, their activity is declining in many parts of the world, due to increasing levels of resistance developed by the PM fungus.

For this reason, very few New York growers still rely on the DMIs for PM control during the critical bloom through fruit-set period. Nevertheless, DMI fungicides have remained useful components in many control programs, and it is beneficial to consider how resistance to these materials develops and

Table II: Effect of rate, timing, and number of myclobutanil sprays on control of powdery mildew and the selection of resistant fungal isolates (cv. Seyval, Finger Lakes, NY)

Treatment, rate/Acre	Timing ¹	% Control, 1996		% Control, 1997	
		Total ²	Resistant ³	Total ²	Resistant ³
Check	—	0	0	0	0
Rally, 4 oz	1 – 6	76	51	84	59
Rally, 2 oz	1 – 6	40	18	49	29
Rally, 4 oz	1 – 3				
Microthiol, 4 lb	4 – 6	81	88	80	81
Microthiol, 4 lb	1 – 3				
Rally, 4 oz	4 – 6	44	n.d.	52	40
Rally, 2 oz	1 – 3				
Microthiol, 4 lb	4 – 6	12	0	61	64

¹ Spray timing: 1 = 2 wk pre-bloom; 2 = 5% cap fall; 3 = 1st post-bloom (+14 days); 4 – 6 = 2nd, 3rd, 4th post-bloom (14-day intervals).

² % Control, total = % control on cluster surface relative to that on the unsprayed checks (checks had 45% and 68% surface area infected in 1996 and 1997, respectively).

³ % Control, resistant = % control on cluster surface of DMI-resistant fungal individuals relative to that on unsprayed checks.

what you can do to minimize resistance in order to maintain their utility.

Resistance to some fungicides (such as Benlate, Topsin-M, Vangard) follows an "all or nothing" model. That is, nearly all individuals in the fungal population are highly susceptible to the materials when they are first introduced, but a few are virtually immune to any amount of it. These individuals build up very quickly once enough sprays are applied to kill off the susceptible population, and because the resistant population is completely unaffected by the fungicide, control failures can occur suddenly if the weather turns in the disease's favor.

In contrast, resistance to DMI fungicides follows a "shades of gray" model. In this case, no individuals are immune, but response to the fungicides is very dose-dependent: an individual that is completely inhibited at one dose may be only partially inhibited at a lower dose. Furthermore, individuals within the pathogen populations vary widely in their susceptibilities to the materials, showing a typical bell-shaped curve with respect to the distribution of their sensitivities. That is, most individuals will require an "average" dose for control. Decreasing proportions will require progressively lower or higher doses to achieve the same level of control.

It is important to recognize that fungicide rates are set by experimentation (usually on populations with little previ-



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ous exposure to related materials), and that economic and regulatory pressures encourage labeling of the lowest rates that will provide full control of about 98% or 99% of the "baseline" population.

However, once such a fungicide (or group) has been introduced and applied repeatedly, the most sensitive members of the population get eliminated, leaving only those that require a "full" rate, along with the original few that were only partially controlled by that rate. If the dose is then reduced — either intentionally or through poor spray coverage — many such individuals become capable of growing to variable extents. Although they may be at least partially controlled by each spray, they gradually build up to damaging levels. Eventually, the fungicide "just doesn't work as well as it used to."

For powdery mildew, this "creeping" loss of control typically happens more quickly in regions where many generations or disease cycles occur every year (moderate summers) versus

those with shorter periods of fungal activity (long, hot summers).

Based on the above, there are a few simple rules to minimize development of resistance to DMI fungicides and thus maintain their usefulness into the future:

1) *Always* use full labeled rates with excellent spray coverage. Remember, the fungus doesn't react to the rate in the tank, only to the rate on the vine.

2) Limit the seasonal use of these materials (we recommend a *maximum* of three applications per season).

3) Use these fungicides early in the season or to maintain a clean vineyard later, but *do not* use them to clean up a PM epidemic that's gotten out of hand. (The larger the PM population, the better the chance for selecting resistant individuals when you spray the fungicide.)

The three principles were tested in New York during the 1996 and 1997 seasons, in a commercial vineyard of the hybrid cultivar Seyval (Chardonnay parentage). A buildup of the DMI-resistant segment of the PM population had

resulted in Bayleton giving poor control by the early 1990s and the performance of Rally (sold as "Nova" in the eastern U.S.) was just starting to slip.

Various fungicide programs were imposed, using six spray applications at 14-day intervals beginning two weeks pre-bloom and continuing through veraison. By varying both the application rate of Rally and the rotational pattern with sulfur, we examined a number of combination strategies:

- Rally at our recommended rate of 4 oz/acre versus 50% of that rate;
- Three sprays each of Rally and sulfur compared to six of Rally only;
- Rally in the first three sprays, before disease was apparent, compared to the last three sprays, after significant PM was visible.

Disease was rated before harvest, and 40 individual mildew colonies from each treatment were tested in the lab to determine their resistance status. In this way, we could calculate not only the total disease control, but also the

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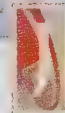
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control of the resistant portion of the population in each treatment.

The results in Table II (page 20) demonstrate that the three theoretical anti-resistance principles actually work under real world conditions. In this particular case, limiting Rally to three applications per season in rotation

with sulfur, using the material before the disease was well established, and maintaining our recommended rate of 4 oz/acre provided the best total disease control and the least selection of resistant mildew individuals.

The *strobilurin fungicides* (Abound, Flint, and Sovran, plus additional

materials still under development) appear to be the most important new group of fungicides since introduction of the DMIs. Because the "strobies" are likely to become increasingly important in grape disease management, it's worthwhile to understand how they work. These are excellent protectant fungicides, providing their best activity when present on the foliage or fruit before a spore lands and tries to infect. They also provide some post-infection control against PM, although it is less reliable and possibly more dangerous in terms of future resistance development.

Additionally, the strobies show significant "anti-sporulant" activity. That is, when applied after infection has occurred but before symptoms develop, they may allow lesions to form but inhibit the production of new spores from those lesions. This is a particularly significant attribute, since it limits the infectious agents responsible for continued disease spread.

Resistance warning

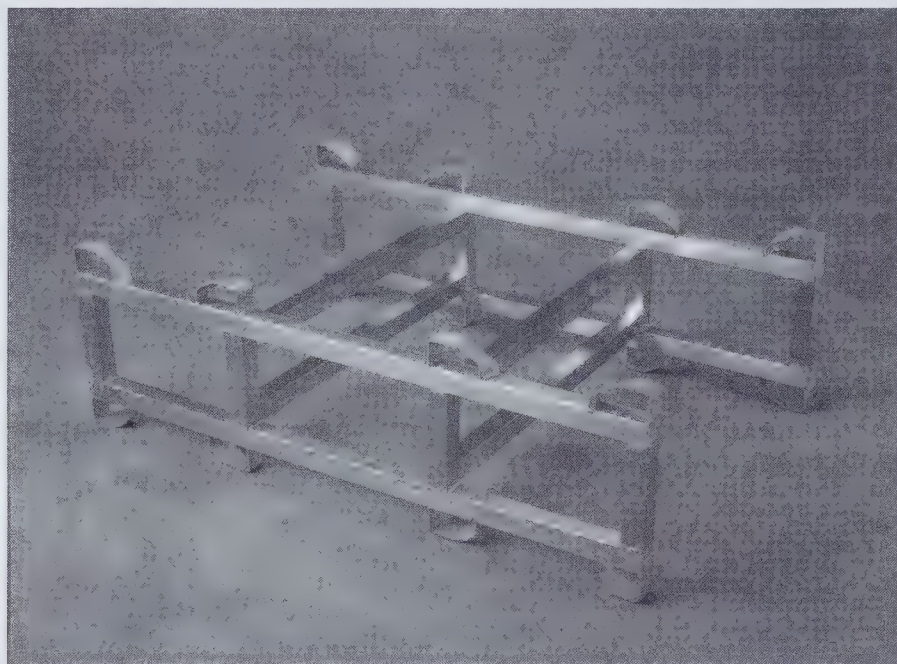
The risk of fungal pathogens developing resistance to the strobies appears to be high. To date, strobilurin resistance has followed the Benlate (all or nothing) model, *i.e.*, most resistant isolates are virtually immune to the fungicides and multiply with impunity if they are not controlled by some other material, such as by tank-mixing with sulfur. Therefore, it will be critical to manage these materials carefully in order to maintain their effectiveness over time.

Minimize the number of annual applications (cost should encourage that!), use in strict rotation with other fungicide groups, and don't spray a strobie as an emergency "rescue" treatment if PM gets out of control.

Alternative fungicides

The PM fungus is different from all other fungal pathogens of grapes in that it grows primarily on the surface of infected tissues. Thus, it is vulnerable to topical applications of various materials that do not control other diseases, whose causal organisms are embedded within the tissues and not exposed to such treatments.

"Alternative" products that are labeled for PM control on grapes include various oils, potassium salts (monopotassium phosphate, potas-



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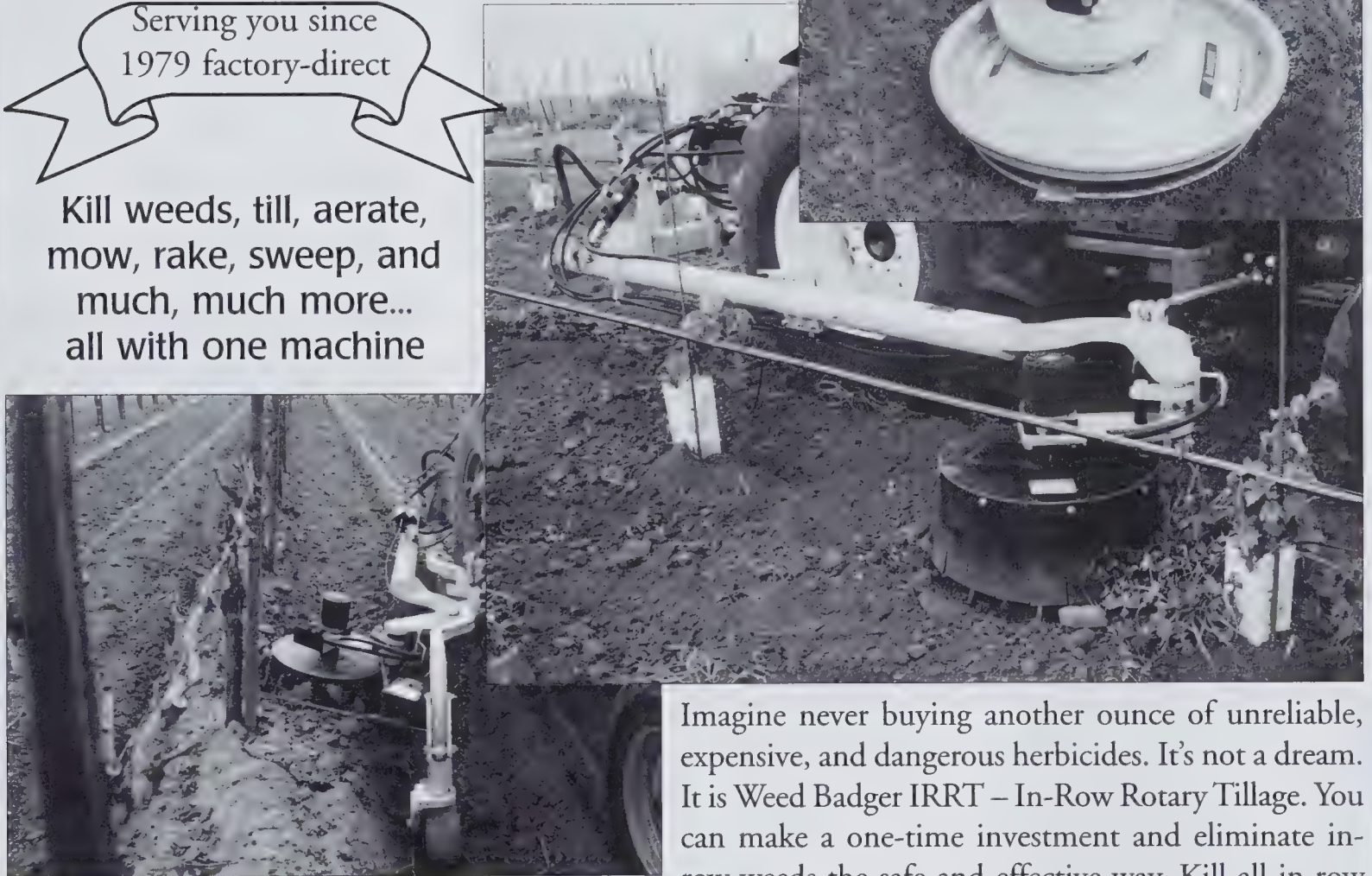
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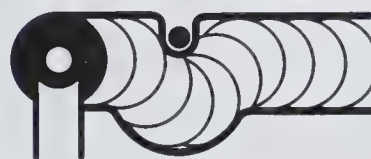
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sium bicarbonate), and dilute solutions of hydrogen peroxide. In extensive tests with one such material — monopotassium phosphate — we've found that it provides virtually no protective or residual activity, *i.e.*, no control when sprayed on plants that were inoculated with the PM fungus one to

10 days later. In contrast, we've found significant eradivative and anti-sporulant activity when it was *thoroughly* applied one to seven days *after* inoculating with the fungus.

Similarly, we've gotten much better activity in field trials when plants were sprayed every seven days (numerous

post-infection "hits") compared to every 14 days with twice the rate (same amount of fungicide per season, but only half as many "hits").

I suspect that this scenario (a quick knockdown with little or no protection against subsequent infections) is applicable to some of the other "alternatives" (such as bicarbonates, oils, and hydrogen peroxide), and that they'll need to be applied on a more frequent basis than traditional fungicides. Of course, such activity as there is assumes complete coverage of the leaves and fruit, which often is problematical.

Take-home messages

- The period of PM activity is determined by temperature. Extended periods greater than 90°F will arrest its development, whereas growth is "explosive" at temps in the mid-60s to mid-80s.

- Although less important than temperature, high humidity promotes disease development and low humidity reduces it.

- Grape berries are highly susceptible to PM from flowering until shortly after fruit set, and serious disease losses are a result of control failures during this time. This is when attention should be most sharply focused on control (best materials and application techniques) if temperatures are at all favorable to the disease.

- Although DMI fungicides remain effective in many vineyards, their efficacy has been compromised by resistance in many locations. Limited-use, conscientious choices of rates, and thorough application techniques should be implemented in order to maintain their usefulness.

- New strobilurin fungicides are extremely effective against PM, but their use should be limited for resistance management purposes. Two applications during the flowering and/or early post-flowering period have provided superior control of fruit infections while also providing supplementary control of Botrytis.

- PM is uniquely susceptible to topical applications of numerous alternative products (oils, potassium salts, hydrogen peroxide). However, these appear to act primarily as temporary eradicators, with little or no protective activity against new infections. ■

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Thinking inside the Black Box

BY Tina Vierra

If Europeans can get past the bottle, then Americans can, too. This thinking drove Ryan Sproule, a computer software veteran, to start Black Box Wines (Walnut Creek, CA) in June 2002. First release was a 2001 Napa Valley Chardonnay in January 2003. In — you guessed it — a black box.

"Fine wine has been sold in boxes in Europe for years, but this will be the first super-premium boxed wine available in the U.S.," Sproule says. He

noticed the European box wines during travels there and was impressed by the taste of the wines. Bag-in-box packaging has long been used for bulk wine sales in the U.S., but not for premium wines. Sproule's challenge, therefore, is to get past the low-brow image of the boxed wine product.

Chardonnay for the first release was sourced from three Napa Valley vineyards, in Carneros, Oakville, and Rutherford. Production totaled 5,550 gallons, or 7,000 boxes. The Chardonnay was 100% barrel fermented, then blended and finished by Sam Gabrielli at Gabrielli Winery in Ukiah, CA. A Merlot is also scheduled for release in 2003.

At a suggested retail of \$24.99 per box, which holds the equivalent of four regular 750ml wine bottles, consumers get Chardonnay for about \$6.25 per bottle, in a package that will keep the wine fresh for up to four weeks after opening.

Sproule's target markets for Black Box include knowledgeable consumers who want to enjoy super-premium wines daily but look for lower prices; consumers who already drink premium wines in 1.5 liter bottles and so already look past the traditional 750ml package; consumers who already drink boxed wine but want better quality wine; and restaurants/bars serving wines by the glass.

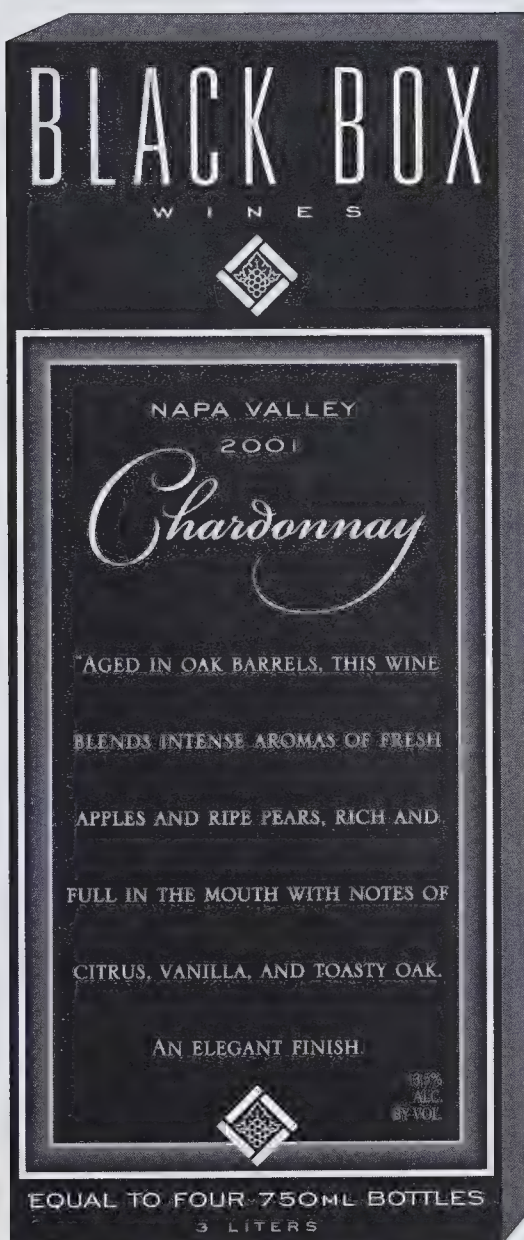
Initial retail outlets include Draeger's Market in San Mateo, CA, and two of the Wine Club stores in the San Francisco Bay area. American Wine Distributors of San Francisco will handle storage and delivery.

Sproule used a mainstream retail package designer for Black Box rather than a wine package designer, and the boxes were printed by the Color Box division of Georgia Pacific. The look was kept simple but — Sproule hopes — upscale, with gold type printed on a black background. The package is varnished to protect it from scuffing.

The plastic bag containing the wine is a Scholle Durashield-45, a three-layer, 3.0-liter container. The outer layer of the bag provides an oxygen shield which gives the wine a six-month shelf life.

Shipping and storage of Black Box wine are cost-effective because the shippers contain 18 liters (as opposed to 9.0-liters in traditional shippers), and have a small storage "footprint." Keeping the short shelf-life in mind, Black Box will practice what Sproule calls, "just-in-time-packaging": boxing the wine, date coding the boxes, and immediately getting it through to market. He plans a three-month sell-through of each varietal as it is produced.

Advantages of bag-in-box packaging for retaining flavor while storing wine have long been known. Sproule finds that resistance to switching the packaging is inherent to the wine industry itself but not necessarily found among consumers. "Ultimately if the product is successful, it will be a win-win scenario for both the wine industry and the consumer. The industry needs a conduit for the glut of grapes, and the consumer needs easier access to high-quality, everyday wine." ■



Just five inches square and 9½ inches tall, the compact Black Box requires less shelf space than the equivalent four bottles of wine.

Australian wine-in-box exported to U.S.

BRL Hardy (Australia) is packaging boxed premium wines for the U.S. market. The brand, called "Hardy Stamp of Australia," debuted on the West Coast in Safeway stores in February 2003. Pacific Wine Partners (PWP) is the distributor.

Debbie Emery, PWP western regional sales manager, says the Australians have sold boxed wines successfully on their own soil, and feel ready to try it in the U.S. "Aussie consumers are not troubled by poor perception of boxed wines compared to bottled wines, and BRL Hardy hopes Americans will soon believe what a good idea boxed premium wines are," adds Emery.

Hardy's boxed line includes Chardonnay, Cabernet Sauvignon, and a Shiraz. Safeway has agreed to take only the Shiraz in 3-liter boxes at a suggested retail of \$15. Hardy also bottled the same wines in 750ml and 1.5L bottles. Safeway is hedging its bets by carrying all three varietals in bottles simultaneously with the boxed Shiraz. The 1.5L bottles retail for a suggested \$7.99.

AVF-FUNDED RESEARCH

Flavor formation during grape juice fermentation

BY Dr. Susan E. Ebeler, Assoc. Professor
Department of Viticulture & Enology
University of California, Davis
seebeler@ucdavis.edu

Flavor complexity in wine is derived from many sources, including grapes, yeast and microbial fermentation, and post-fermentation treatments, such as oak storage and bottle aging. Compounds formed during yeast fermentation are quantitatively the most important volatile components in wines and include alcohols, esters, carbonyls (such as acetaldehyde and diacetyl), and sulfur compounds.

Many of these compounds are also potent odorants and contribute to the characteristic flavor of wines (such as acetaldehyde and the esters, 3-methylbutyl acetate, ethyl octanoate, and ethyl hexanoate).¹⁵ However, when present at high levels some of the fermentation derived flavors may be undesirable (such as hydrogen sulfide

and fusel alcohols), contributing off-odors to the finished wines.

A number of winemaking conditions can influence the production of volatiles during fermentation.²⁰ For example, ester concentration is governed by yeast strain, temperature, nutrient availability, pH, unsaturated fatty acid/sterol levels, and oxygen levels.^{1,2,19,21,24,29,33,35,36} Sulfur dioxide additions impact diacetyl and acetaldehyde levels.^{12,13,18,23,27,30} Finally, nutrient composition and nitrogen status of the must influence fusel alcohol and hydrogen sulfide production.

Although a great deal is known about the influence of winemaking conditions on the volatile composition of a finished wine, little is known about the dynamic changes in volatile production that occur during fermentation. While numerous factors can contribute to the production or loss of flavor compounds during fermentation, the times at which these factors may become significant during winemaking are not known. In general, this is because monitoring volatile production during fermentation has been a challenging procedure.

However, the development of solid phase micro-extraction (SPME), a rapid, simple, and solventless sampling technique, now enables the nearly-contin-

uous monitoring of volatiles during fermentation. Using this technique, we can now obtain greater insight into yeast metabolism and the influence of winemaking practices on flavor formation.

Traditionally, liquid-liquid extraction (using pentane, Freon 11, or Freon 113 as the extracting solvent), simultaneous distillation/extraction, and dynamic and static headspace sampling methods have been used for wine flavor analysis.^{11,14,19,28,33,34} However, these methods can require the use of large amounts of purified solvents, which are costly to use and dispose of. They can suffer from poor sensitivity and loss of analytes during extraction and concentration. In general, these methods are also fairly laborious, require relatively expensive glassware, and are not easily automated.

Recently, SPME has been used for analysis of a wide range of flavor compounds in wine and other alcoholic beverages.^{3,4,5,10,16,17,26,38,39,40} SPME involves the concentration of analytes by adsorption (or absorption) onto a polymeric material, which is coated onto the end of a fused silica fiber. Extraction is based on partitioning of the analyte among the three phases present in the sampling vial — the liquid, the headspace of the vial, and the SPME fiber.³¹ The lack of solvent use, the relatively short extraction times, and the potential for automation make SPME a simple, efficient, and effective method for continuous sampling of volatiles during fermentation.

Project goals / objectives

The overall goal of current SPME research at UC Davis is to develop a model for batch alcoholic fermentations that will describe the overall production of important wine flavor compounds

Table I. Selected applications of SPME for analysis of volatiles in wine and other alcoholic beverages

Analyte (Matrix)	Reference
2,4,6-Trichloroanisole (wine)	Evans et al., 1997
4-Ethylphenol (wine)	Evans, 1997
Dimethylsulfide (beer)	Scarlata et al., 1999
Chiral alcohols, esters, lactones, norisoprenoids and terpenes (wine, malt beverages)	Ebeler et al., 2001a, b
Esters (wine)	Vianna and Ebeler, 2001
General volatiles (brandy)	Ebeler et al., 2000

As the research arm of the wine and grape industry in the U.S., the American Vineyard Foundation (AVF) identifies high priority research issues through industry surveys. This text reports on a high priority research project funded by AVF, and conducted at the University of California, Davis. Dr. Susan Ebeler is project leader, Associate Professor, and Analytical Chemist in the Department of Viticulture & Enology. Dr. Ebeler's work focuses on the investigation and analysis of volatile flavor compounds in grapes and wines, and the correlation of analytical methods with grape and wine sensory properties. The AVF expresses its appreciation for efforts of Dr. Ebeler and members of her laboratory, and its pleasure at being associated with her programs. For more information on projects funded by the AVF, visit AVF's website at www.avf.org.

Harvest Bins

Although interchangeable with Valley bins from other manufacturers, Western Square's two-ton bin has features which have earned it the reputation for the best designed bin in the industry.

The D-ring end is ribbed so that the stress from lifting a full bin is distributed over the entire height of the bin, not just the D-ring itself.

Side walls, end walls and bottom sections are lapped, so that welds are on flat surfaces, not on edges or corners.

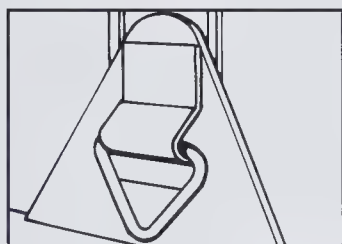
The top rail is formed to provide excellent rigidity and dimensional stability. The channel on the outside of the rail is blocked to prevent the hooks of the gambrel from catching.

These features give Western Square's two-ton bin the strength and dimensional stability needed for years of trouble-free use, but without added weight. Western Square's bin weighs only 435 pounds. The outside dimensions are 8' x 4' x 4'.

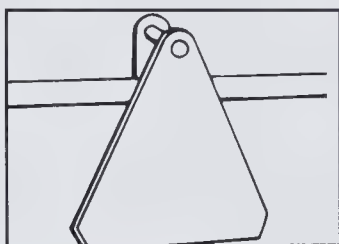
Western Square is the only manufacturer to use powder coating (baked enamel) to coat steel bins. The inside coating of the bins is FDA-approved food grade epoxy powder coating in a choice of white or gray. The outside coating is exterior grade polyester powder coating which is available in several colors.

Also available in stainless steel.

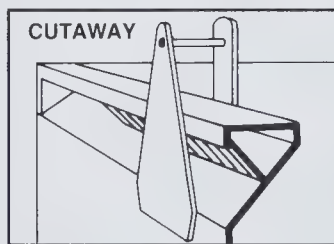
Forged D-Ring (rated at 20,000psi) mounted on ribs, spreads the stress of hoisting over a maximum area.



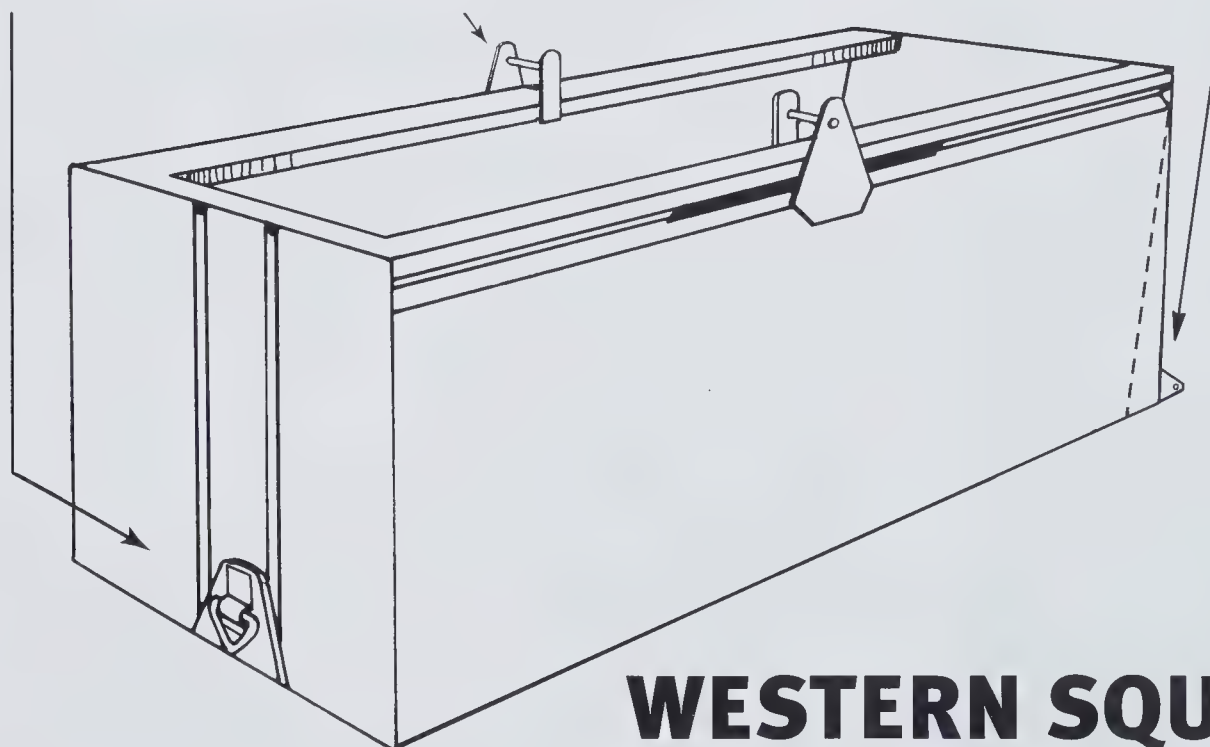
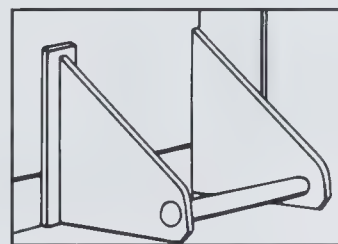
Lifting pins and pivot pins welded to triangular shaped plates for maximum strength.



Sides of bin made with roll-formed steel. No weld required on inside. Smooth surface for best grape release.



"Thru-holes" design. Pins welded on both sides of each plate. (Not butt-welded).

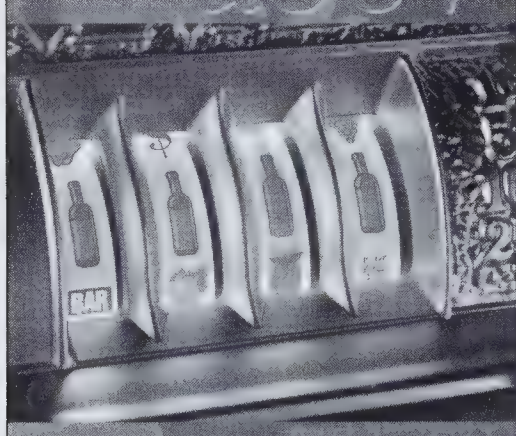


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during yeast fermentations. The resulting model can be used to describe the effects of yeast inoculum level, fermentation temperature, and CO₂ production on the flavor composition of wine.

Results and discussion

In several previous studies, we have demonstrated the general applicability of SPME for volatiles analysis of wine and other alcoholic beverages (Table I). In general, the SPME procedures are highly reproducible and sensitive (ng/L level for TCA), providing results that are

comparable to or better than those of other sample preparation methods.

In the current work, we adapted the SPME technique for the "continuous" monitoring of ester production throughout grape juice fermentations.⁴¹ Fatty acid and acetate esters contribute important fruity characteristics to wines.

Fermentations were carried out in one-liter glass fermentors at constant temperature (18°C) with constant stirring (100 rpm). Fermentation was monitored by weight loss (CO₂ evolution) approximately every 12 hours until the

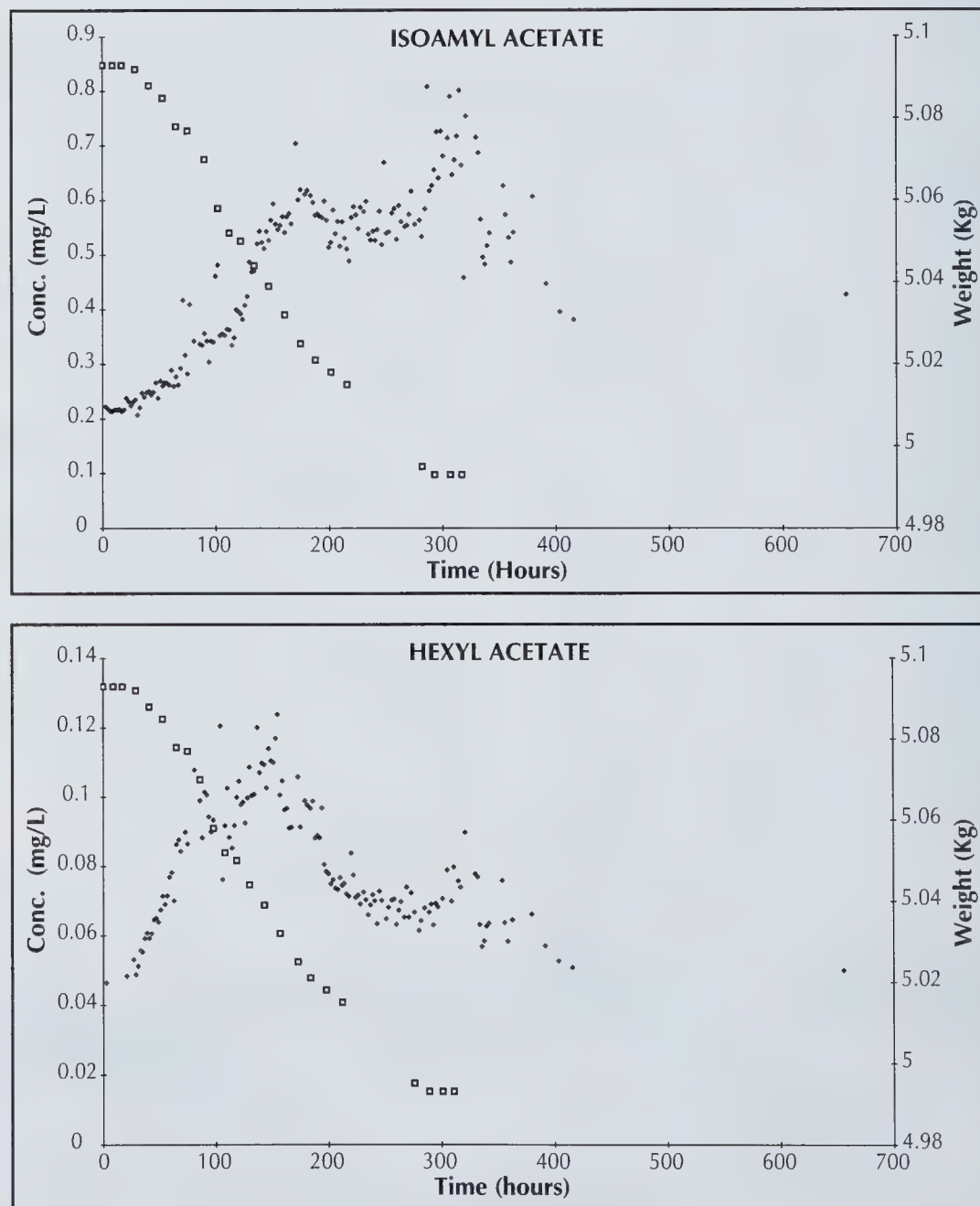


Figure 1. Production of acetate esters during fermentation. Open squares indicate progression of the fermentation as monitored by weight loss. Data points represent the average of two fermentations. (Copyright Vianna and Ebeler, 2001, with permission.)

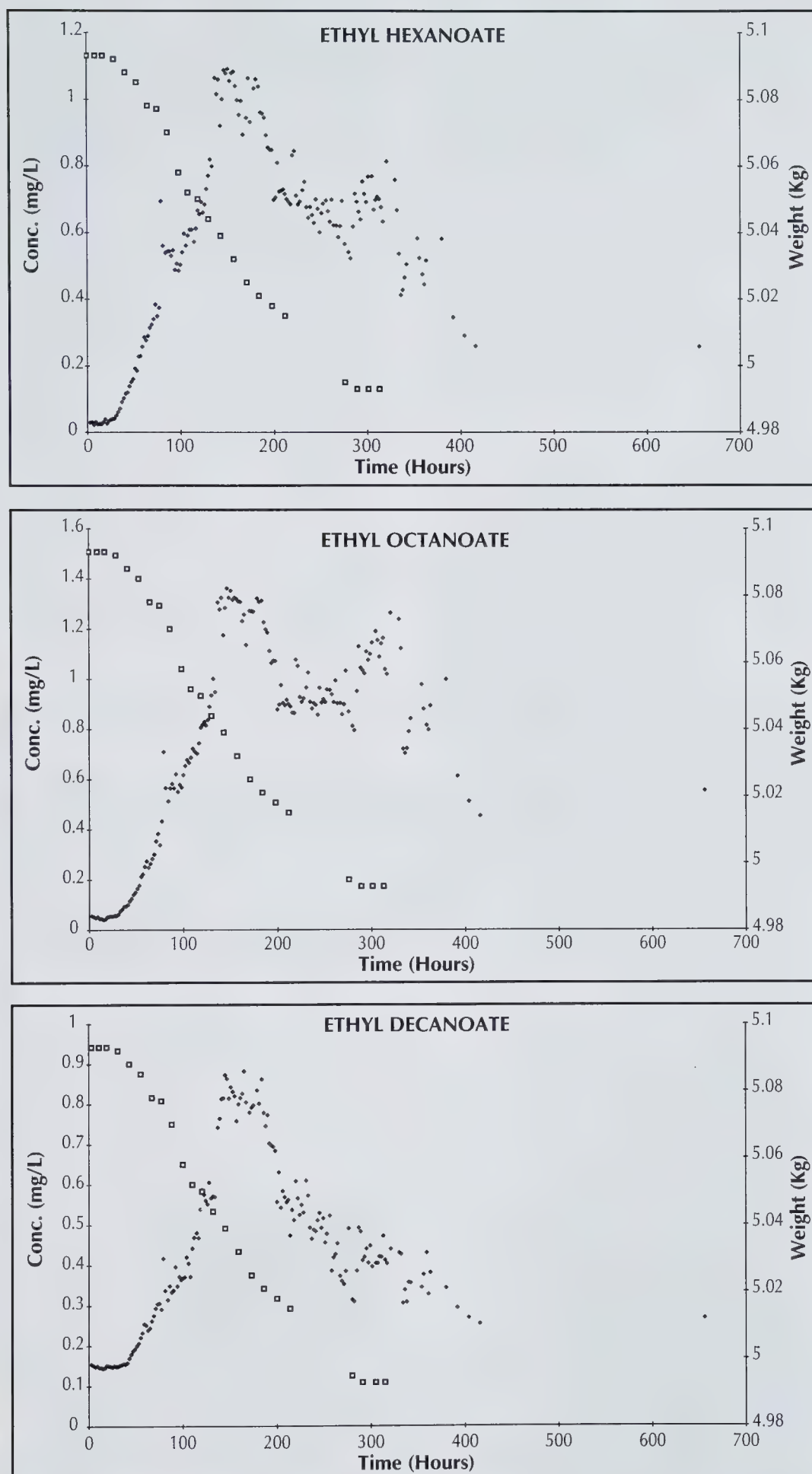


Figure II. Production of fatty acid ethyl esters during fermentation. Open squares indicate progression of the fermentation as monitored by weight loss. Data points represent the average of two fermentations. (Copyright Vianna and Ebeler, 2001, with permission.)

weight stabilized and residual sugar levels were less than 0.25%.³⁰

These studies were done using Chardonnay juice inoculated with *Saccharomyces bayanus* var. Prise de Mousse. The juice was supplemented with diammonium phosphate (DAP; 0.4 g/L) to insure sufficient nitrogen content. SPME headspace sampling was performed by manually exposing an SPME fiber through a rubber septum in the lid of the fermentor for an absorption time of one hour followed by immediate injection and analysis by gas chromatography.

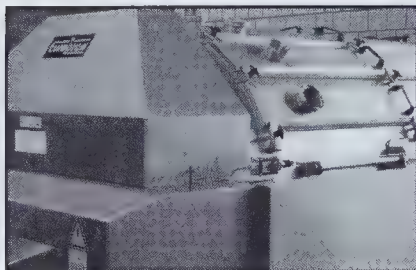
A nonpolar, PDMS (poludimethylsiloxane; 100 μ m) fiber was used for monitoring volatile esters. During sampling, the tip of the SPME fiber was approximately 3 cm above the liquid in the fermentor, and the needle was offset from the center of the fermentor by about 3 cm to avoid hitting the stirrer. Sampling was initiated approximately three hours after inoculation and continued every other hour until the juice fermented to dryness. Additional samples were taken for several days after completion of the fermentation.

Ester concentration in the samples was determined from standard curves that were prepared using authentic standards diluted into model wine solutions.⁴¹ One liter of each standard solution was prepared and sampled by SPME in the same fermentors used for the juice/wine samples in order to duplicate the headspace and volume conditions of the actual fermentations. The SPME sampling and GC analysis protocols for the standards were identical to those used during fermentation monitoring.

Using these procedures, differences in production of acetate and fatty acid ethyl esters were observed and related to progression of the fermentation (Figures I and II). Interestingly, production of ethyl acetate and isoamyl acetate followed similar production profiles, while hexyl acetate levels showed a markedly different pattern of production.

The reasons for differences in production of hexyl acetate as compared to ethyl acetate and isoamyl acetate are unknown. In general, acetate esters are dependent on the initial production of the corresponding fusel alcohol (for example, isoamyl acetate production requires isoamyl alcohol as a precursor).

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In contrast, hexanol (the precursor alcohol for hexyl acetate production) may be initially present in the juice, leading to a more rapid production of the ester.

The three fatty acid ethyl esters (Figure II) showed patterns of ester production that were nearly identical to each other, but were different from the acetate ester profiles. Production of the fatty acid ethyl esters coincided with production of ethanol in the fermentation. Maximum fatty acid ethyl ester concentrations occurred mid-point in the exponential phase of the fermentation and then concentrations subsequently dropped until the end of the fermentation. Reasons for the rapid decline in ethyl ester concentrations are unknown; however, some enzymes specifically responsible for ethyl ester synthesis have been shown to be inhibited by high ethanol concentrations.²²

These studies have shown that there is still much to be learned about

the kinetics of flavor formation during yeast fermentations and that SPME can be a valuable tool for monitoring flavor development. However, in order to better characterize these ester production profiles, further information on concentrations of alcohol precursors, enzyme activities, and yeast cell viability is needed.

Using the SPME headspace technique, it will now be possible to evaluate the effects of yeast strains, yeast inoculum level, cell viability, fermentation temperatures, and other fermentation variables on the formation and/or loss of flavors during fermentation. The method can also be readily adapted to monitor production of other important flavor and off-odor compounds, including sulfur compounds.

Summary

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in flavor production throughout grape juice fermentations. By identifying important variables that may influence ester formation (such as fermentation rate, yeast species and inoculation rate, fermentation temperature, etc.), we will ultimately be able to provide winemakers with information and tools that they can use during the winemaking process to optimize and control the flavor of the final wines. ■

Acknowledgements

The author acknowledges the assistance of many students and visiting scholars involved in this project, including Elizabeth Vianna, Darren Rathbone, Roland Adden, Silke Asimont, Kyungmi Min, Alberto Iandolo, Seung-Joo Lee, Ryan Hodgins, and James Duane. Financial support has been provided by the American Vineyard Foundation and the California Competitive Grant Program for Research in Viticulture and Enology.

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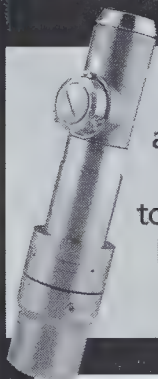
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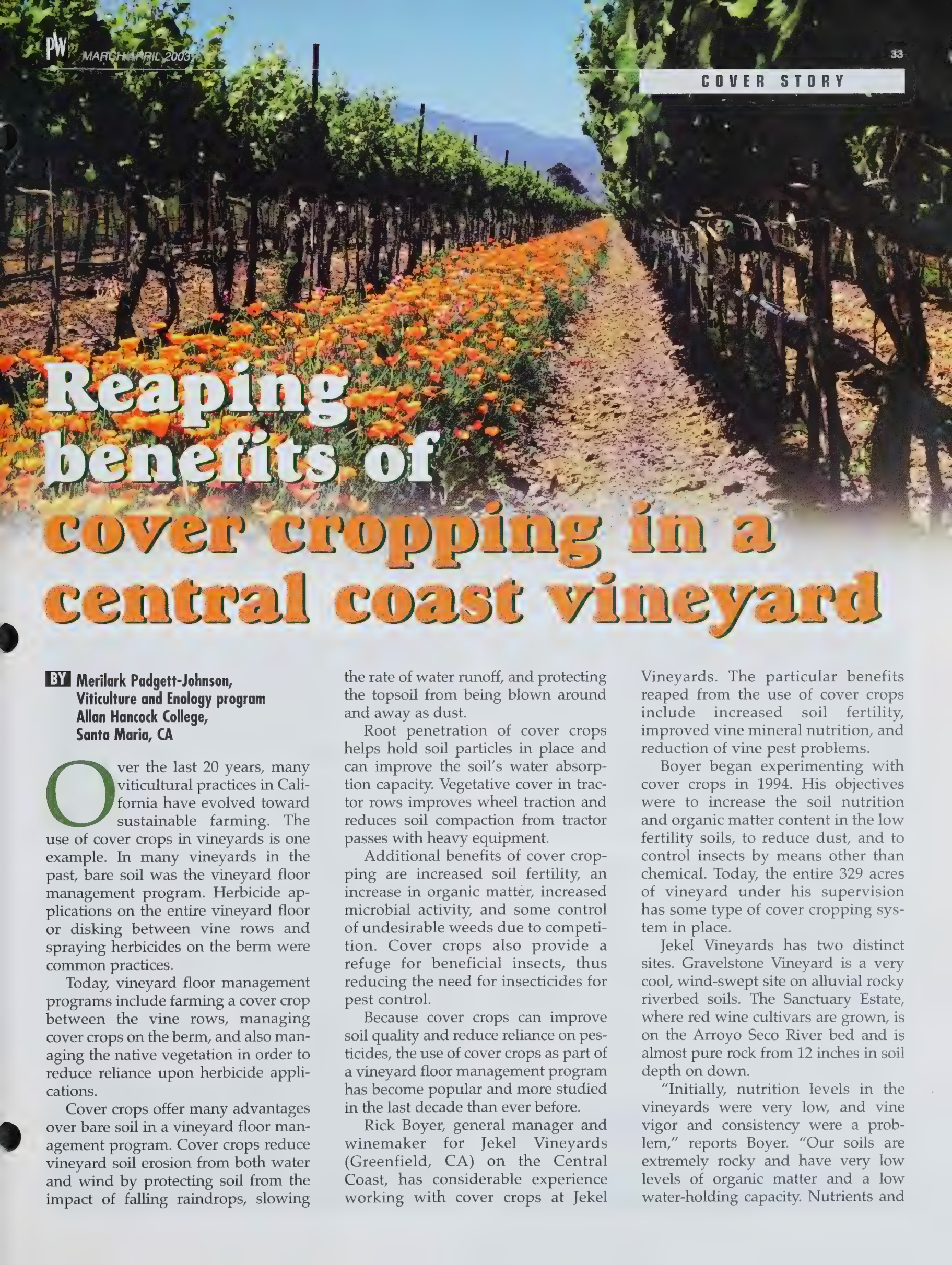
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Reaping benefits of cover cropping in a central coast vineyard

BY Merilark Padgett-Johnson,
Viticulture and Enology program
Allan Hancock College,
Santa Maria, CA

Over the last 20 years, many viticultural practices in California have evolved toward sustainable farming. The use of cover crops in vineyards is one example. In many vineyards in the past, bare soil was the vineyard floor management program. Herbicide applications on the entire vineyard floor or disking between vine rows and spraying herbicides on the berm were common practices.

Today, vineyard floor management programs include farming a cover crop between the vine rows, managing cover crops on the berm, and also managing the native vegetation in order to reduce reliance upon herbicide applications.

Cover crops offer many advantages over bare soil in a vineyard floor management program. Cover crops reduce vineyard soil erosion from both water and wind by protecting soil from the impact of falling raindrops, slowing

the rate of water runoff, and protecting the topsoil from being blown around and away as dust.

Root penetration of cover crops helps hold soil particles in place and can improve the soil's water absorption capacity. Vegetative cover in tractor rows improves wheel traction and reduces soil compaction from tractor passes with heavy equipment.

Additional benefits of cover cropping are increased soil fertility, an increase in organic matter, increased microbial activity, and some control of undesirable weeds due to competition. Cover crops also provide a refuge for beneficial insects, thus reducing the need for insecticides for pest control.

Because cover crops can improve soil quality and reduce reliance on pesticides, the use of cover crops as part of a vineyard floor management program has become popular and more studied in the last decade than ever before.

Rick Boyer, general manager and winemaker for Jekel Vineyards (Greenfield, CA) on the Central Coast, has considerable experience working with cover crops at Jekel

Vineyards. The particular benefits reaped from the use of cover crops include increased soil fertility, improved vine mineral nutrition, and reduction of vine pest problems.

Boyer began experimenting with cover crops in 1994. His objectives were to increase the soil nutrition and organic matter content in the low fertility soils, to reduce dust, and to control insects by means other than chemical. Today, the entire 329 acres of vineyard under his supervision has some type of cover cropping system in place.

Jekel Vineyards has two distinct sites. Gravelstone Vineyard is a very cool, wind-swept site on alluvial rocky riverbed soils. The Sanctuary Estate, where red wine cultivars are grown, is on the Arroyo Seco River bed and is almost pure rock from 12 inches in soil depth on down.

"Initially, nutrition levels in the vineyards were very low, and vine vigor and consistency were a problem," reports Boyer. "Our soils are extremely rocky and have very low levels of organic matter and a low water-holding capacity. Nutrients and

COVER STORY

Table I. Bloom-time vine petiole analyses from Jekel Vineyards.¹

Year	Nitrate Nitrogen (ppm)	Potassium (%)	Phosphorous (%)
2000	1100	0.2	1.0
2001	2400	0.35	1.6

¹ Samples taken from the Gravelstone Vineyard Pinot Noir block #2; analyses performed by Western Farm Service.

water flow through the soil profile and out of the root zone quickly. We needed to increase the retention time of the nutrients and water within the root zone."

Continual use of cover crops in the vineyards since 1994 has resulted in an overall improvement of soil tilth and increased soil organic matter content. An increase in the organic matter increases the soil's cation exchange capacity, making the nutrients in the soil more available to vine roots. Vine petiole analyses from Jekel Vineyards demonstrate that vine mineral nutri-

tion has improved over the years (Table I).

Another soil problem Boyer had to contend with was nematodes. Experimentation to suppress ring nematodes with cover crops, such as the new varieties of mustard, cahaba vetch, and oil seed radishes, is ongoing. The incorporation of liquefied shrimp shells into the soil has also aided in nematode suppression (Table II). Though the action isn't clear, chitin in the shrimp shells is thought to stimulate the increase of chitin-eating fungi in the soil. The fungi then destroy the nema-

tode eggs by feeding on the chitin in the egg shells.

"In the past, we put out ground up shrimp shells and worked them into the soil, which is a mess," reports Boyer. "Now we put them in a liquefied form through the drip system at 20 gallons per acre in late March. Gravelstone Vineyard at the winery has received three applications in the last four years. The Sanctuary Vineyard has received two applications. We will continue with this program as we have a reliable source of the liquefied shells now."

The use of cover crops also has a role in suppression of vineyard pests above ground. Dust abatement due to cover crops helps to suppress mite infestations. Spider mites and leafhoppers were both present in the Jekel Vineyards in the early 1990s. Beneficial insect releases were implemented, along with the new cover crop program in 1994, and this contribution has

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Table II. Jekel Vineyard ring nematode (*Criconemella xenoplax*) counts.¹

Year	Nematodes / kg soil
1999	1610
2000	1320
2001	252
2002	530

¹ All samples taken in August; analyses performed by Nematodes Ltd., Selma, CA.

eliminated spider mites and significantly reduced the numbers of leafhoppers.

Large numbers of predatory mites (*Persimilis* spp.) were released in 1994 and 1995, and a population of predatory mites has persisted since then. Boyer notes that a selection of a specific cover crop (mixture of sweet yellow clover and New Zealand white clover), which stays green and vegetative longer into the summer, is a real aid in dust control in blocks of grape varieties that have heavy tomentum (leaf hairs) on the under side of the leaves.

One component of the Jekel cover crop management plan is to have an insect-attractant mix in every seventh tractor row. There has been extensive experimentation with which types of crop to use in the designated insect-attractant rows. As the insect populations change, Boyer foresees continual adjustment of the cover crops in these rows.

The current overall cover cropping regime is to plant alternating tractor rows of several different seed mixes. One tractor row has a mix of 30% oat and 70% pea, while the alternate row is seeded with 70% cahaba white vetch and 30% cayuse oats or 80% adagio oilseed radish and 20% cayuse oats. In very sandy soil, the oat/pea mix is planted in one row and the alternate row will have 70% strawberry clover and 30% New Zealand white clover.

One of two insectary cover crop seed mixes is used, depending upon the vineyard (Table III).

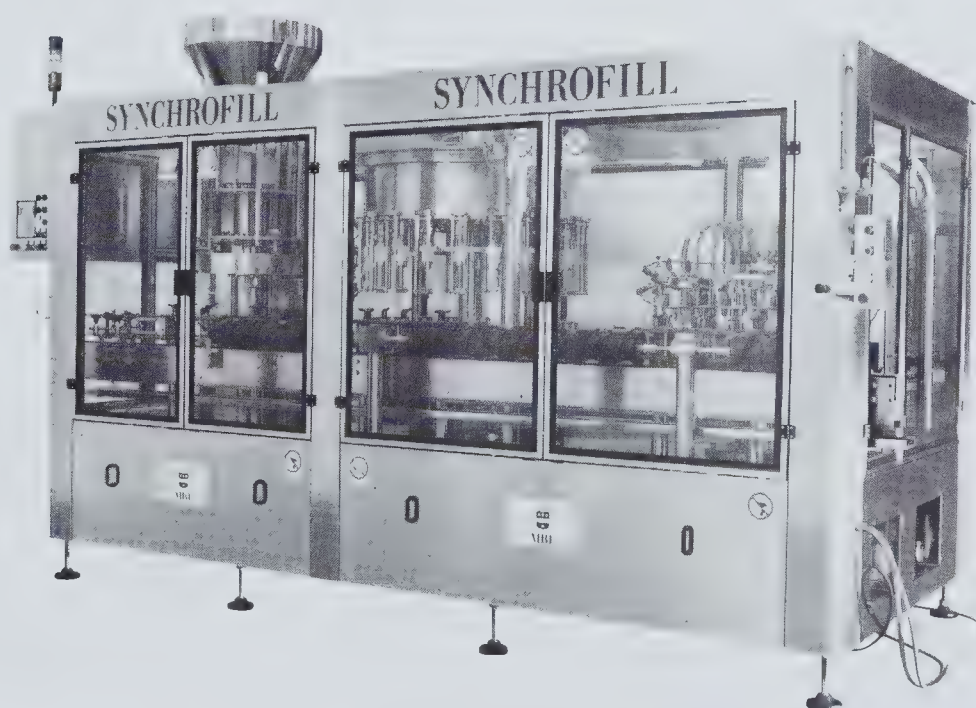
Soil preparation in the tractor rows includes turning under the cover crop in the spring with a

Tortella spader. After harvest, the vineyard receives an overhead sprinkling to help weed seeds germinate. One disking is done, followed by one pass with the spader and ring roller. "The spader helps create a very nice uniform seed bed," says Boyer, "there

are still rocks there, but they are manageable." A 4½-ft-wide Tye drill is pulled by a wheel tractor to drill the cover crop seed into the soil.

About 80% of the vineyard has overhead sprinklers and drip irrigation, and the vineyard is sprinkled to help achieve

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Table III. Insectary seed mixes planted at Jekel Vineyards

Seed Type	Seed Mix # 1	Seed Mix #2
Dwarf Cornflower	10 %	2 %
White Yarrow	5 %	6 %
Dill	3 %	4 %
Cilantro	3 %	4 %
Alyssum	10 %	12 %
California Golden Poppy	13 %	15 %
Crimson Clover	10 %	10 %
Santiago Bur Medic	4 %	
Mogul Barrel Medic	4 %	
New Zealand White Clover	8 %	
Rose Clover	8 %	
Sweet Yellow Clover	8 %	20 %
Birdsfoot Trefoil	6 %	
Indian Blanket	4 %	
Black-eyed Susan	4 %	
Strawberry Salina Clover		12 %
Pergin Alfalfa		12 %
Plains Coreopsis		3 %

an even and quick germination. The remaining vineyard relies on rainfall for germination. "Once germination occurs,"

explains Boyer, "we rely on natural rainfall as much as possible to keep the cover crop going throughout winter and spring."

The insectary row is seeded after harvest. "We try to keep the insectary rows going for three growing seasons," reports Boyer. "After three years, the alyssum and poppies start to dominate the mix. Malva (pigweed) and wild slender oats also become a problem, so we turn the mix under. We allow the newly seeded insectary rows to germinate and establish themselves before we turn the old insectary rows under. We believe that this will allow a good cross-over of good and bad insects to the new habitat and food source before we remove the old insectary rows."

The other seed mix choices can vary according to vineyard site because of differences in the soil. In the very rocky areas, Boyer chooses a permanent (perennial) grass cover mix of hard fescue, red fescue, and sweet yellow clover. This mix has been in the ground for five years after drilling seed at 25 lbs per acre.

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"We mow clover rows three times in the spring (March, April, and May) to suppress weeds and encourage thicker growth," explains Boyer. "They will start to flower and set seed in June, but as long as we give these rows some water, they will stay green until late July. We irrigate the clover rows (for dust suppression) with overhead sprinklers. Height of the clover is just below the top growth, about five to six inches. Other cover crops are not mowed.

"The second- and third-year insectary rows are mowed once in the fall after harvest and once in the early spring (February/March) to cut down the clover, which will thicken up quickly and help to suppress weeds. After mowing the clover to a height of two to three inches above ground, sunlight on the soil helps germinate seeds from the previous cover crop that compete quickly with weed-competitors. Debris from the old cover acts as a light mulch for the germinating seeds.

"The alternate tractor rows of peat/oat mix and the oat/vetch mix are turned under in the spring or late summer (in the summer cover areas). We can have 3½-foot-tall growth of vetch or peas and oats and turn them under with one pass of a spader. We do not mow them before turning under. These crops are seeded at 100 lbs per acre to increase nutrition and organic matter."

Except for the insectary rows, every tractor row is seeded every year. "The decisions about what to plant change each year as we ask new questions and talk with others who work with cover crops," adds Boyer.

"We are always looking for organic matter and some nutrition," concludes Boyer. "Our objective with cover crops is to create balance in the vineyard, to have a system that works in balance with nature, so we are caretakers of that space on the earth. We like to provide what the vines need in a natural state — to have the 'good guys' and the 'bad guys' (predators and prey) be in balance, so we do not have to spray to take care of a problem." Boyer continues to fine-tune his management

of cover crops to further improve winegrape quality. ■

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LETTERS TO THE EDITOR

COUNTERPOINTS TO RICHARD SMART'S HANG TIME

PWV received the following responses to Dr. Richard Smart's column in the Jan/Feb 2003 issue questioning the value of "hang-time" in enhancing grape quality. We welcome further dialogue on this and other topics of interest to our readers.

A larger view of "Hang Time"

It was surprising to read Dr. Richard Smart's diatribe on "hang time" in the Jan-Feb 2003 *PWV*. So surprising, in fact, that I was motivated to draft this response. This effort is made in the interest of advancing the understanding of vine behavior.

Right up front, I wish to declare that I am a fan of Dr. Smart. He has revolutionized how the industry views grapevine canopies. In his seminal book, *Sunlight into Wine*, Smart has raised interest in the importance of solar radiation to vine function and fruit production.

After years of reliance on an overly simplistic view of temperature as the sole criterion of matching grape varieties with growing sites, we saw Dr. Smart's publication open up a whole new array of light-related factors. It was the first such breakthrough since 1973, when Oregon's Warren Aney introduced the evapotranspiration index as a more comprehensive measure of macro-climate suitability to a largely dozing wine industry.

As with any scientific advance, Dr. Smart's research on solar radiation provides a jumping-off point for others who are willing to make the effort to further develop the concept's applications.

Having said that, it is also my contention that the concept of hang time is much broader in scope and validity than was outlined by Dr. Smart, and it all has to do with climate. I can recall references being made to hang time going back 20 to 25 years in Oregon.

The cool climate factor

First, hang time means more in marginal climates than it does in overly-

endowed warm climates where Smart apparently spends most of his own "hang time." Most of California and Australia fit the warm climate definition. There, measures aimed at reducing the vine's heat and light uptake would seem to make more sense than extended time on the vine.

"Cool climate" means areas where heat and light are sufficient, in most years, to bring the fruit to acceptable levels of ripeness. As a general guide, the industry considers cool climates to be those with less than 2,500 degree-days. In those climates, *extended hang time*, or extended time on the vine after "acceptable ripeness" is reached, can make the difference between an outstanding wine and one that is merely average.

The 100-day rule

"Hang time" is a season-long concept. It begins with the end of bloom and ends when the fruit is harvested. In Burgundy, there is an old rule of thumb that harvest occurs 100 days after full-bloom, give or take two to three days. In the 25 years I've tracked such things in Oregon, that formula has worked in all but two years. That's an empirical statement about hang time.

Photosynthesis drivers

Photosynthetic activity in the leaves is what drives all vine development. In photosynthesis, light photons convert carbon dioxide and nutrient ions into carbohydrates, which are the building blocks for sugar and acid in the grapes, and all of the vine's parts: grapes, leaves, canes, trunk and root system. The photosynthetic rate, or velocity, is driven by both heat and solar radiation contacting the leaf.

But, there are limits to both relationships. The industry bible, *General Viticulture*, presents curves tracking heat and light versus CO₂ assimilation in controlled environment studies — some with Dr. Smart's fingerprints on them. Carbon dioxide assimilation by the leaf is used as the measure of photosynthesis.

Both heat and light reach a zone of diminishing incremental returns in photosynthetic gains, then turn to negative returns. Ultimately, the leaf's survival mechanism shuts down photosynthesis and the leaf respire water for cooling.

Plant response to light is also interesting in that a substantial amount of radiation energy penetrates to the vine on overcast days, even when it is cool.

These considerations of heat and light partially explain why the vine seems to have a magical ability to compensate for the climate. In cooler years, biological ripeness occurs at lower cumulative degree-days, lower sugar and pH, with higher acidity. In hotter years, the opposite pertains. The reason: in a hotter year, a lot of heat occurs when the leaf does not respond; in a cooler year, solar radiation keeps right on going during cooler days.

That's what makes potential evapotranspiration so intriguing; it is a composite index that summarizes heat and light influences. Now, if we can just figure out which, and what parts of, the 25+ PET formulas are the best for winegrapes.

Warmer years are best?

Most of the world's greatest wines are produced in marginal climates. It should come as no surprise that most of the great years in Burgundy and Bordeaux happen in the warmer years. Those are the years when perfect ripeness occurs at the right time, and the winemaker doesn't have to gamble with birds, rain, and mold.

What is ripeness?

"Biological ripeness" is the attainment of mature flavors and aromas typical for the variety. "Phenological ripeness" is a numbers game: the achievement of ideal sugar, acid, and pH levels. The former is most important to astute winemakers; the latter is the primary focus of growers because contracts make it so. Also, numbers are objective while taste and smell results are subjective. Choose your camp.

As a general rule, intense flavors develop during final ripening, when the process is stretched out by slowing it down, coupled with a strong push-pull on the vascular system brought by warm days and cool nights. There, in the proverbial nutshell, is the secret of hang time.

More meaningful research findings

I can't let this opportunity pass to put forward a favorite cause. The realm of quality winemaking would be greatly enhanced if viticultural researchers on that international road show called "symposia" would extend their evaluation of vineyard practices from phenological scales to measures of biological ripeness by sensory evaluation of the resulting wine.

What that means is that measures such as sugar, acidity, and pH signify no more than arrival at the ballpark, and they are adjustable in the winery. On the other hand, sensory evaluation by a professional tasting panel discriminates among walks, singles, and homers. Information of value to winemakers includes: what flavors, aromas, and tactile properties are affected, and by how much.

Comparisons like "richer, more complex cherry-berry flavor," "A is more tarry than B," and "more like black fruits than red," are useful to winemakers, unless they're "handcrafting" their wines in million-gallon tanks. "Wine B was better than Wine A" just doesn't cut it.

In summary, I would say that contrary to Dr. Smart's contentions disparaging the value of hang time, the concept does find meaningful application in cool climates. I do agree with him, however, that it doesn't make any sense to leave fruit on the vine for an extended period in warmer climates, where the conditions don't exist for slow ripening. ■

Jeffrey L. Lamy, MS

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Richard Smart's reply:

I am in agreement with many of the issues raised here, but not all. Certainly ripening is very different in hot, warm,

and cool climates. Maybe some readers will offer a clear definition as to what is "hang time." My original column aimed to have people think that there is more to vineyard manipulation of wine quality than just delaying harvest. I hope readers pick up on that message! Long may the debate continue.

Richard Smart

Bordeaux isn't Woodside

Contrary to his typically insightful writing, Dr. Richard Smart's column in the Jan/Feb-2003 *PWV*, "Hang the Hang Time" is misleading.

The premise of the column is that early-harvested grapes, if farmed properly, are phenologically ripe when they become "sugar ripe" and only go downhill with added hang time. The 2000 study of Jones and Davis in the *American Journal of Enology & Viticulture* supposedly showed that "earlier vintages were typically of better quality." That's true — and misleading — when applied to California vineyards.

The Jones and Davis paper analyzed Bordeaux wines from 1952 through 1997. There is no doubt that every great Bordeaux vintage in this century (1928, 1929, 1945, 1949, 1959, 1961, 1966, 1975, 1982, etc.) had both a late bud break and an early harvest, but the conclusion that short hang time means great vintages does not follow.

In Bordeaux, the average Cabernet Sauvignon crop during the study period achieved only 22° Brix at harvest. Bordeaux, unlike California, has a climate where grapes struggle to get ripe. The extra "hang time" in poor Bordeaux vintages is often associated with cold, rainy summer weather, crops with less than 22° Brix in mid-September, and the necessity of leaving the crops vulnerable to fall rains and mildew to get adequate sugar levels. In other words, bad weather forces longer hang time in poor years. Conversely, good years in Bordeaux are *caused* by good weather, which also causes shorter hang time. Good years are thus *correlated with* (not caused by) short hang time. Both

good years and short hang time are caused by good weather.

By contrast, California grapes almost always get sugar-ripe, but those "grassy" 1970s Cabernets still in my cellar tell me that those grapes were not phenologically ripe at harvest. They were still loaded with methoxyprazine compounds ("grassy," "green bell pepper") that would have disappeared if those grapes had hung longer on the vine.

In my own experience with Pinot Noir (an early ripener), I have seen (in 1997) clusters at 25° Brix with green seeds produce a tight, astringent wine. Since then, we have used every watering and pruning method at our disposal (thanks, Dr. Smart) to keep the grapes on the vine as long as possible before sugar ripeness forces harvest. The results are remarkably better for longer hang time on California Santa Cruz Mountain Pinot Noir.

Dr. T.J. Rodgers, Winemaker
Clos de la Tech, Woodside, CA

Richard Smart's reply:

Thanks to Dr. Rodgers for his letter. It is a useful contribution to the debate. It is nice to know that my writing has encouraged some questions. My central premise is that there is more to vineyard manipulation of wine quality than delaying harvest. I think it is a modern-day aberration which will get rectified, probably by consumer response. I want to reassure Dr. Rodgers that I too have seen "grassy" Cabernets and other varieties, and not only from the 1970s. And they can have quite high sugar levels. In my experience this is due to shaded canopies and/or too cool ripening conditions. Delayed harvest might improve but not rectify the situation. Better I think to identify and attack the cause. Are the grapes which hang longest on the vine destined to make the best wine? How about harvest after leaf fall? How about Napa "frost" wine? May the debate continue.

Richard Smart

MAXIMIZING SAFETY IN CONFINED SPACES

BY Tina Viera

From largest to smallest, all wineries have to address the workplace issue of safety in confined spaces. While fatal incidents are few, experts report that working in a confined space is one of the top three safety concerns in the wine industry. (The use of ammonia and disposal of waste water are the other two safety concerns.)

According to the U.S. Bureau of Labor Statistics (BLS), an average of 6.1 workers out of every 100 in private industry filed a claim for an injury or illness serious enough to cause lost work time in 2000 (latest data available). For workers in "Wines, brandy, and brandy spirits," the numbers are even higher — 8.4 cases per 100. These statistics suggest the wine industry is more hazardous to workers than the average.

"The industry must gain a greater understanding of the risks and better control of high hazard activities as an integral part of daily operations," says Stephanie Rhine, a safety consultant with Environmental and Occupational Risk Management (EORM) in Sunnyvale, CA.

"Traditional safety management thinking is not the most effective practice in light of the liabilities winery employers are faced

with in the host of high-risk activities they perform," adds Rhine. "Prudent employers must seriously focus on their hazardous work activities to protect themselves from accidents, worker fatalities, lawsuits, criminal actions, and the consequences of dealing with Cal-OSHA from the wrong side of the table."

Defining confined spaces

The Occupational Safety and Health Administration (OSHA) defines a confined space as having the following characteristics:

- It is large enough and configured such that an employee can bodily enter and perform work;
- It has limited openings for entry and exit;
- It is not designed for continuous employee occupancy;
- Existing ventilation is insufficient to remove dangerous air contaminants and/or correct oxygen deficiency; and
- Access to or egress from the space is difficult.

Each winery must decide whether its confined spaces, fitting the definition above, are also Permit-Required Confined Spaces (PRCS). Most winery confined spaces are PRCS, as you'll see by assessing whether the fol-



Raul Lopez working safely in a confined space (red fermentor) at Shafer Vineyards, Napa, CA. Photos by Fred Lyon.

EMPLOYEE SAFETY

lowing characteristics apply to your confined spaces:

- It contains or has a potential to contain a hazardous atmosphere;
- It contains a material that has a potential for engulfing the entrant;
- It contains inwardly converging walls or a floor that slopes downward and tapers to a smaller cross-section where an entrant could be trapped or asphyxiated;
- It contains any other recognized serious safety or health hazard (such as moving parts, unsafe temperature, electrical shock, or corrosive chemicals).

If your winery has a PRCS, you are required to inform and train employees about it for their safety. First, inform all employees of the existence and dangers of each PRCS by posting danger signs on each opening of a PRCS and around it. Simple language is best: "DANGER: Permit-Required Confined Space. Do Not Enter." Wineries with non-English-speaking employees should also post the signs in Spanish or other languages as necessary. OSHA guideline language is sketchy on details like this — when in doubt, post signs in all languages that are appropriate to avoid potential problems.

If a winery decides to handle a PRCS by simply not allowing employees to enter, it must prevent entry by installing physical barriers, such as locks or bolts. If you have a tank and have worked out a system for filling, emptying, and cleaning it without entry, you should post signs and lock the tank to prevent entry. Signage and entry prevention are the limits of a winery's required duty in this situation.

If a winery decides to allow employee entry to a PRCS, it must develop a written program, train all workers in the area of the PRCS to use the program, and document the program implementation. If you have a tank so large that entry is required to clean it, OSHA expects that you'll have a full PRCS program in place and all employees trained in entry and rescue before anyone enters that tank.

PRCS procedures

A representative PRCS program used by a winery would follow Title 8

Cal-OSHA guidelines, sections 5156-5158. These guidelines are available on the Division of Occupational Safety and Health website: http://www.dir.ca.gov/occupational_safety.html. Addresses and phone numbers for local OSHA offices can also be found on the site.

Guidelines for a PRCS program are outlined below. Please refer to the Title 8 Cal-OSHA guidelines 5156-5158, as referenced above, plus any other relevant state and federal regulations before taking action.

Training rescuers

Develop and implement procedures for in-house and off-site rescue capability. Two-thirds of all confined space fatalities occur among would-be rescuers. OSHA reports that fatalities occur when rescuers are overcome by their emotions, take unnecessary chances, do not know the hazards involved, do not have a plan of action, and lack confined-space rescue training. *Always* assume that a confined space is hazardous. Train — in order of importance — for self-rescue, non-entry rescue, and as a last resort, PRCS-entry rescue.

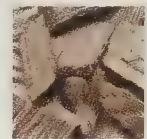
Mark Aniello, Environmental Compliance and Remediation (Walnut Creek, CA), trains winery clients on self-rescue and non-entry rescue. Under no circumstances, he stresses repeatedly during training, should attendants or anyone else enter a PRCS if an entrant is in distress. "You can't ignore the statistic that most fatalities happen to the would-be rescuers."

Entrants into a PRCS are trained by Aniello to be alert, know the dangers, and be able to identify distress symptoms. Their only responsibility is to their own safety in a distress situation — not to other entrants or to rescuers or attendants except to communicate distress and the intent to get out of a PRCS. Winery clients are trained by Aniello on the use of harnesses, including tripods and ladders when necessary, for non-entry rescue. His most common training regimen is simple harness use and side-of-tank ("horizontal") entry when possible.

There is a four-minute time window for confined space rescue. After that

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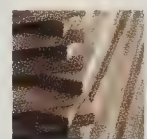
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Four-gas instrument used to monitor air quality within a PRCS.

much time without oxygen, a worker will experience asphyxiation, resulting in brain damage or death. Cal-OSHA requires that minimal rescue training

must include recognition of confined space hazards, control of these hazards, use of atmospheric monitoring equipment, use of personal protective equipment, use and maintenance of rescue equipment, annual (or more frequent) practice of confined space rescues, proficiency in cardiopulmonary resuscitation (CPR), and documentation of training.

Fire department and rescue information should be at the employees' fingertips or posted handily, suggests Aniello. It is uncommon for him to find winery personnel who are trained in CPR or first aid. Aniello estimates that, despite the Cal-OSHA requirement, 95% of attendants will not be certified in first aid or CPR. Annual rescue training and practice are vital, particularly just prior to harvest when PRCS use increases.

It is advisable that wineries test, through practice, important rescue

factors, such as quick access to needed equipment and supplies, space configurations in your fermentation room or PRCS, physical obstacles to rescue, distance to safe or outside air, and total time needed for rescue operations of various types. Always keep in mind the four-minute rescue time window.

Develop emergency services for post-rescue employees who have suffered injuries. Rescued employees and rescuers might suffer asphyxiation, cuts and scrapes, broken bones, or other injuries that can be treated on site or before emergency crews arrive. Train employees and practice CPR and first aid.

PRCS entry

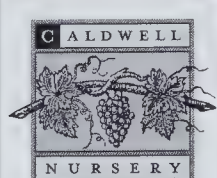
Ensure that pre-entry preparations are outlined and completed. Flush, wash, drain, or ventilate the PRCS as much as possible before entry.

Measure and monitor hazardous conditions before and during entry. In a winery, the most obvious hazardous conditions in confined spaces are atmospheric, such as in fermentation rooms or tanks. Employees cannot rely on sight or smell to detect a dangerous atmosphere, so there is literally no substitute for testing the air in a confined space with proper equipment.

Air testing procedures must follow a certain order, according to OSHA. Testing for oxygen is first because an oxygen-deficient (below 19.5%) or oxygen-rich (above 23.5%) atmosphere is dangerous to humans. Combustible gases and vapors are tested next because of fire threat. Finally, toxic atmospheres are tested.

Though it may seem obvious, **do not enter a PRCS to perform the initial atmospheric tests!** Many modern instruments allow the air to be tested remotely, while providing simultaneous detection of multiple gases. Winery confined space atmospheric tests may routinely show the same environment if the space is used repeatedly in exactly the same way, but OSHA recommends that employers never take shortcuts in atmospheric monitoring. Keep in mind that "entry" into a PRCS means any part of a per-

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son's body — an employee could put a hand or dip his head into a PRCS and would be in danger *and* in violation of OSHA regulations.

Testing must also be done at all depths in the confined space because some gases are heavier than others. Continue to monitor the air in the PRCS during the entry, since atmospheric conditions may change. If workers leave the area for a break, testing must be performed again before re-entry. The atmosphere can change rapidly within confined spaces and conditions may turn lethal even during short periods.

Choice of testing instruments

Buying the right testing equipment is critical. Experts advise that you must have a multi-function instrument or one that has multiple sampling/testing capability. The instrument must be direct-reading (real time) and capable of being field-calibrated against a known standard each and every time before it is used to sample or test a PRCS.

Larger safety supply companies typically carry instruments specifically designed for confined-space atmospheric testing applications from several manufacturers, with kits ranging in price from \$1,000 to \$3,000.

Most instruments measure one or more of the following gases:

- Oxygen, 0% to 30% by volume in 0.1% increments,
- Hydrogen sulfide (H_2S), 0 to 999 parts per million (ppm), in 1 ppm increments,
- Carbon monoxide (CO), 0 to 999 parts per million in 1 ppm increments,
- Combustible gases; Lower Explosion Limit (LEL) / Lower Flammability Level (LFL), 0% to 100% in 1% increments.

CO_2 and SO_2 are the most common hazardous gases found in confined spaces in wineries and appropriate instruments must be available for these gases.

The instruments also typically have audible and visual alarms/set points, are intrinsically safe, and are powered by rechargeable, nickel-cadmium batteries. Most manufacturers offer calibration gas/span gas kits and a requi-



Entrant, Jesus Perez, Geyser Peak Winery, Geyserville, CA, demonstrates correct entry into a tank wearing a harness with cable being held by attendant, Michael Vronoski, cellar manager. Self-Contained Breathing Apparatus (SCBA) is available for the attendant, in case a rescue is required.

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site regulator valve, tubing, and alarm set-point adjusting tools.

Most kits contain a replacement pump filter, a dust filter/water stop, a spare battery charger, and a carrying case. Safety experts advise clients to order an additional instrument manual and keep it with the instrument at all

times. Some manufacturers also offer training videos or will offer operator training seminars for their respective instruments.

Check with colleagues or winery neighbors to determine the manufacturer's record of after-the-sale service, which is also very important.

Posting attendants

OSHA requires that at least one attendant be posted immediately outside the PRCS to monitor safety of the entrant; experts also recommend that a second attendant be nearby, in the area of the PRCS. Many wineries are very small and may not feel they have enough employees to post an attendant during a confined space entry, but you must. Import a spotter for the day if necessary — either train a friend or neighbor to help out or hire a professional. Be sure to consult your insurance representative about liability in these situations.

What winery — large or small — wants to absorb the expense of having two or three employees performing a simple tank cleanup? However, the potential cost of foregoing attendants — and the resulting risk of employee injury or death — is simply too high.

The entrant and attendant form an entry team and have specific responsibilities, as does the entry supervisor. The entrant should be responsible for his own safety by participating in the entire entry process. The team of entrant and attendant are responsible for pre-entry work, tools for the job and for safety measures, monitoring hazards, communication, and rescue if needed.

The attendant may not have other duties outside the entry process. Once entry begins, the attendant should remain positioned just outside the PRCS, monitoring all entrants and their activities and any activity outside the space. Communication with entrants and responsibility for ordering an evacuation or rescue if the entrants appear to be in danger rests with the attendant.

The entry supervisor (in small operations, this is often the employer) is the third member of the entry team. He/she is responsible for overall entry operation. The supervisor should know the hazards of the PRCS and the employee's training background. He/she must ensure that testing and preparation have been done and that all equipment needed is available. The supervisor then signs an entry permit and cancels the per-

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Associate winemaker Chris Munsell (Geyser Peak Winery) displays SCBA components for use by attendant if rescue of entrant is required.

mit once the operation is completed. Again, OSHA has very specific language about the responsibilities of the three participants in a PRCS entry — please refer to OSHA guidelines for full details.

Contractors are required to meet all Cal-OSHA regulatory requirements. If you are using a contractor to work in or around a PRCS, coordinate between the contractor and your own winery procedures for the safety of all. The contractor's employees should know your procedures and you should know theirs. Make sure both entities are compliant and can work together on safety issues.

Ventilate the PRCS before and during the entry. After determining the number and size of openings, atmospheric characteristics, volume and con-

figuration of the space, and potential hazards, ventilate and monitor throughout the entry.

For best ventilation in a PRCS, such as a fermentation tank, blowers are recommended at the top and bottom, paying attention to the density of vapors for which you are ventilating. If the gas is heavier than air and thus "sitting" at the bottom of the space, blow fresh air into the fermentor at the top and exhaust out through the bottom. If the gas is lighter than air, reverse the airflow.

Respirator solutions

Respiratory protection is often necessary in a PRCS. If a space is determined to be hazardous during atmospheric testing and if an emergency exists that makes quick entry imperative without air testing and if ventilation alone cannot guarantee a safe atmosphere, then rescuing employees must be fully

trained and must each strap on a respirator before entry. OSHA requires that wineries provide and maintain all necessary tools and equipment at no cost to employees. For a PRCS, this includes respirators.

Providing respiratory protection for employees requires more than a quick trip to the hardware store. Respirator use requires employee training and thoughtful equipment selection.

There are three types of respirators: air purifying (APR), supplied air (SAR), and self-contained breathing apparatus (SCBA).

An APR does *not* supply air. It merely filters out low levels of contaminants. While it may be useful in fermentation rooms, it is not approved for a PRCS.

The SAR respirator does supply air. It supplies clean air into the employee's face piece via a hose to a compressor that is drawing air from a clean, uncontaminated source. An SAR usually maintains positive pressure (with respect to ambient air) in the respirator face piece, affording the wearer higher levels of respiratory protection. Air can also be supplied to the respirator by a back bank.

The SCBA provides the most comprehensive protection and may be most appropriate for winery use. The SCBA face piece and regulator valve assembly operate almost identically to a positive-pressure SAR face piece. However, instead of dragging a hose line around, you carry your breathing air in a cylinder on your back as a firefighter does.

Unfortunately, the SCBA has drawbacks. The air cylinder contains only enough air for 30 to 60 minutes of normal breathing, but an employee carrying up to 25 pounds of SCBA and working usually consumes the air in the cylinder much quicker. Also, since most confined spaces have very limited openings for entry and egress, the wearer and the SCBA may not fit through the PRCS opening at the same time.

Communication procedures

A communication system must be in place for employees in a PRCS. Wineries and their employees must develop both language and hand signals to communicate their PRCS procedures that are clear to all. OSHA also suggests a tapping code for tank entries and light signals for dark spaces.

Train employees on hazard recognition and control, safe entry, duty proficiency, use of equipment, testing and monitoring, ventilation, communication both verbal and non-verbal, personal protective equipment use, rescue and emergency procedures, and use and filing of the necessary entry permit. Train them on procedures when they are hired and retrain or test them annually on procedures.

Develop an entry permit that addresses all hazards and controls necessary for safe entry. Cal-OSHA provides good examples of such a permit but expects employers to develop their own. Winery situations are distinct from other industrial situations; thus a winery must develop a permit that addresses different needs and parameters for a winery PRCS.

Key elements of a Confined Space Entry Permit include:

- Location and description of nature of confined space hazard,
- Preparation tasks completed prior to entry,
- Equipment requirements,
- Monitoring tests of oxygen, lower flammable limit, carbon monoxide, and carbon dioxide and other applicable gases requiring permissible entry level;
- Time of entry and exit within an eight-hour limit (Cal OSHA),
- Identification of entrant and stand-by attendant, with signature of entry supervisor verifying all policies of entry and completion of tasks have been met.

Download an example of the Confined Space Entry Permit from the Cal OSHA website at: www.dir.ca.gov/dosh/dosh_publications/ConfSpa.pdf and scroll down to page 63. Look for Attachment C (enhanced Title 8 version).

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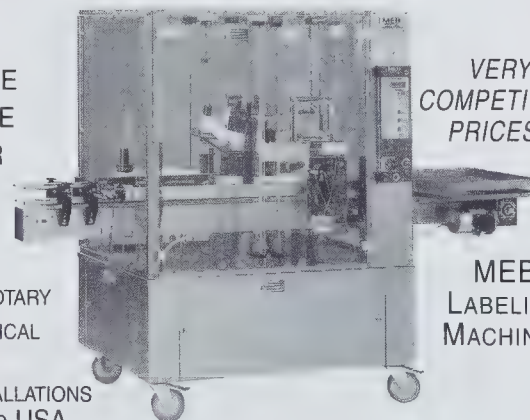


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Entry permits must be signed by the entry supervisor prior to issuance and entry, canceled once entry concludes, and kept on file for at least one year. Permits are used to review the PRCs program. Wineries can use them to review employee training and performance. Cal-OSHA uses them to review

the winery's adherence to safety guidelines.

Review your PRCs program annually and revise it if necessary, to correct any problems detected from reports of the previous year. Document the review. Cal-OSHA has extensive training and education materials available

for wineries. One of the most useful is a 73-page booklet entitled *Is It Safe to Enter a Confined Space?* It is available by writing to Cal-OSHA or by download from the agency's website in PDF format. Also check for federal regulations on the federal OSHA website at www.osha.gov.

In addition, wineries can learn about safety issues through programs at some schools, or talks given by experts, such as EORM presentations at winery association seminars. UC Davis offers a certificate program in workplace health and safety (http://universityextension.ucdavis.edu/certificateprograms/cert_workplace.html). A specific short-course in "Health and Safety for Winery Operations" is offered (most recently in February 2003), and is a useful one-day overview taught by experts such as Carol Barake of Barake & Associates, Folsom, CA.

J Vineyards & Winery

Small wineries like J Vineyards & Winery (Healdsburg, CA) face specific challenges due to the lack of space and of manpower for training — challenges that become more difficult as the winery expands. Penelope Coster, associate winemaker, is in charge of safety efforts and integrates safety training with her winemaking duties. The timing of training is carefully planned.

"Every year personnel involved in confined spaces have to be trained in the procedures. We do this before harvest, so it is fresh in people's minds," Coster states.

The barrel and fermentation rooms have ventilation systems that operate when necessary. The newest room has a CO₂ monitor that activates the ventilation system when the CO₂ reaches a particular level. Again, people are trained to respond when they encounter dangerous atmospheres. SO₂ is addressed using both ventilation and respirators.

"In 2002, the cellar master devised a rake that allowed us to empty out any tank of pomace without entering," Coster reports. "We are rewriting our procedures to be sure that no one

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enters a tank until it has been thoroughly ventilated, and rinsed of all material that could create CO₂. Some very small wineries basically do the same thing, because the tanks are small enough that rakes and rinsing solve the problem."

The tank is checked for the oxygen level before entry and final cleaning can take place. This is done anytime an employee has to enter even a clean tank, just to make sure that it hasn't inadvertently been gassed with nitrogen or CO₂.

After the tank has been cleaned out by rakes and rinsing and is ready for entry, a check-off list must be completed. The list includes everything that must be done and all the equipment that is needed before entry in case of an emergency. This way all equipment and procedures are addressed before anyone enters a tank.

There is also a form to record the oxygen meter calibration and inside-tank readings. The winemakers use an O₂ meter to determine if there is enough oxygen in the PRCS to be entered.

The list then gets checked and signed by the cellar master or a supervisor authorized by the winery as the responsible employee. The tank is ventilated until the oxygen level is at 21% (20.9), safety belts are attached to entry personnel (along with O₂ meters with alarms built-in and set to go off at O₂ levels below 19.5%), and emergency equipment and personnel are arrayed outside the tank. Only then can entry begin.

Shafer Vineyards

Shafer Vineyards (Napa, CA) trains and certifies its cellar staff prior to harvest. PRCS entrant personnel at Shafer

use safety harnesses and cables, and an SCBA respirator is available for attendants performing rescue.

As required by Cal-OSHA, tanks have signs indicating they are a PRCS, and permits are completed before entry. Shafer also ventilates constantly before and during entry. A "buddy" (Shafer's company term for the attendant) is posted outside during entry. Doug Shafer proudly reports that, "in 20-odd years, we've never needed to rescue anyone."

Geyser Peak Winery

Larger wineries often have more extensive safety policies. Geyser Peak Winery (Geyserville, CA) has had strict safety procedures in place for many years. Geyser Peak management is vigilant and continues to update employee safety procedures. Associate Winemaker Chris Munsell explains their program:

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SOIL FERTILITY FOR WINEGRAPES

By NEAL KINSEY

Do excellent soil fertility levels really matter for winegrape production? Can wine grape quality be influenced by what you do or fail to do in terms of soil fertility? Not according to the opinions of a number of those involved with growing winegrapes.

Although such attitudes about fertility are changing throughout the wine industry, because stressing the vines is considered as a positive way to influence wine quality, some grape growers allow soil fertility levels to suffer, rather than using other means to accomplish the task. At KINSEY AGRICULTURAL SERVICES, INC., we strive to convince clients that this approach to soil fertility should not be considered as a viable option in any case.

Soil samples have been received for analysis and recommendations provided to more than 200 vineyards, predominantly from the West Coast of the U.S. Clients include properties from very small production wineries to those with thousands of acres. A large number of winegrape growers have used our services for several years now, either working directly with us, or working indirectly through other consultants and/or fertilizer companies who utilize our soil fertility program.

We use a detailed soil analysis developed by soil scientist, Dr. William A. Albrecht, for making specific fertility recommendations on all types of soils, for our clients in all 50 states of the U.S. and 50 other countries. Our training programs for increasing soil fertility are designed to help those using the Albrecht system understand why high quality wines do not have to come by depriving the soil of its natural fertility requirements. Our specialized program for building top fertility into soils, ultimately results in growing the utmost in quality, without compromising sufficient levels of production, to assure a better return on investment.

Using specially developed soil audits which are obtained by analyzing samples provided from each vineyard, recommendations are given which have been designed to be utilized in growing adequate vines and high quality fruit for each representative soil.

Using basic concepts to identify and resolve soil fertility problems, the program demonstrates how mineral elements must be present in correctly determined amounts based on the measured productive ability of each individual soil. This specific combination of nutrients correctly provides the ideal physical structure for differing soils to provide optimum root development and the biological processes necessary to optimize soil life and plant growth in the aerobic zone.

This is a key area, and the only one that can be positively influenced year by year, if necessary, with correct fertilization. The fertility contained in this zone, which is the depth to which a wooden fence post will rot away, positively influences both production and health of the vines, thus increasing the soil's ability to provide desired plant growth and optimum fruit quality. Essentially, the aerobic zone is the plants' stomach.

It is true that some very good wines can be produced on soils that are very poor in terms of soil fertility. It is being done now and has been done for centuries. However, once it proves feasible to increase production through increased soil fertility, without compromising wine quality, the economics of production become even more attractive. But it should not be expected that winegrape producers, or any other growers, would accept these fertility principles, as such, without some sort of positive results first. That is why we initially encourage prospective clients to test the program beforehand. This can be accomplished in various ways.

Choose a vineyard that does well, where one area is consistently more productive than another, then try the following type of test. Carefully observing the specified sampling procedures outlined on our web site (www.kinseyag.com), take representative soil samples from both areas. Label the samples so that only you can tell which is good and which is not. Send samples from several different sites thus reducing the chances of our choosing the best one. After providing as much information on our soil worksheet as possible, send the samples requesting that they be analyzed for winegrape production with fertilizer recommendations using the Albrecht soil analysis model. Also ask that it be determined which of these soils is best and why.

Continued on next page

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Another possibility is to take a designated vineyard area (not the worst, not the best) and dedicate it to the Albrecht model of soil building for three years. It is imperative that samples be taken as instructed on our web site. This is extremely important, because the recommendations can only be as good as the representative sample. Sample the area at the outset and treat the soil according to nutrients required as shown by the soil test.

After the first year, take follow-up tests and check whether progress is being made in terms of reaching the desired fertility levels on each test. Supply any additional fertilization shown to be required for the next year of production. Do this each year and evaluate the program for three full years as to how and whether performance has improved.

The closer your vineyard soils approach the specified desired levels in the soil analysis, the more improvement you should notice. Evaluate the program based on improvements in both the vineyard soil and the grapes being produced there. Some clients tell us that after using our program for at least three years, they are now achieving higher scores for their wines.

But a lack in general soil fertility is not the only major problem we see in winegrape production. More and more vineyards are striving to use natural materials or grow their grapes organically. Wineries are now making their own compost by combining manure with grape pomace. This is an excellent move, and it provides several benefits for the soils that receive it, so long as use of the material maintains adequate to excellent fertility levels. At least such actions show that not all vineyards believe a lack of fertility grows better grapes.

Always consider that the overuse of even an excellent compost can cause a shortage of some other needed nutrient, particularly when any of the primary nutrients are already high in that soil. The same is true of any soil amendment or fertilizer that provides an inordinate amount of build-up for any element that is already high in that soil. Specifically too much nitrogen can cause a copper deficiency. Copper is only needed in "trace" amounts, along with adequate potassium and manganese, for vine resilience and skin quality in wine grapes.

Too much phosphate and potassium can also hurt grapes instead of helping them. Excessive phosphate levels in the soil can result in zinc and sulfur deficiencies. Too much compost or manure, or even soft rock phosphate, or 11-52-0 (MAP) or 18-46-0 (DAP), can cause this to happen.

In addition, excessive potassium levels will reduce boron availability, needed for nitrogen conversion and the transfer of starch from the leaves to the fruit. When excessive enough, potassium, whether combined with sodium or not, can block manganese uptake, another key nutrient for vine strength, fruit set, and skin quality of the grapes.

Just consider that too much of any essential nutrient can cause problems for grapes, just as too little of any needed nutrient may be a detriment to the vines. A proper relationship between nutrients is required in the soil to achieve the desired response for grapes.

You cannot correctly manage needed nutrients until you have the ability to properly measure them. The Albrecht system of soil analysis, which we use, is based on more than 50 years of soil fertility work using detailed measurements and specially formulated procedures for controlling both excesses and deficiencies in soil used for winegrape production. It is possible to define, measure, and manage soil fertility in order to achieve higher quality in the vineyard. We teach this to clients using a program designed to help growers better utilize soil testing and fertilization for maximum benefit.

The Albrecht Model of soil analysis and fertilization is not and will not become a system whereby all winegrape soils lose their individuality and ability to provide desired qualities to the grapes and resulting wines. But the program does provide the ability to measure and influence the aerobic zone in a positive way.

By using soil chemistry to correct the mineral nutrients, it provides the physical structure that in turn provides the proper environment for the optimum level of biological life in the topsoil. In this regard, the Albrecht Model helps build an environment to better encourage life in the soil, which translates to the grapes and the wine. The deeper soils and rooting depths help to provide the individual character and the desired *terroir* for grapes that make the wine. However, most growers have no real idea as to how the fertility of their vineyard soils measure up.

There are those that observe, "Life only comes from life." Use the utmost in soil fertility to give more life to your topsoil and thus give more life to your vines. Give more life to your vines to give more "life" to your wines.

For more information, please contact us at **Kinsey Agricultural Services, Inc.**, 297 Co. Hwy. 357, Charleston, MO 63834. Telephone: 573/683-3880. Fax: 573/683-6227. E-mail: neal@kinseyag.com. Workshops and training programs are conducted at various times each year as shown on our web site, www.kinseyag.com. The most extensive is the five-day Soil Quality Workshop at Little Creek Acres near Escondido, CA, from June 16-20, 2003. This meeting is confined to a small group, so space is always very limited. See our ad on page 49.

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EMPLOYEE SAFETY



PRCS sign posted on tank requiring permit to enter. Geyser Peak Winery uses icons as well as text in case of any language barrier.

"All of the winery's rooms and enclosed areas where fermentations occur are monitored by permanent CO₂ meters mounted on the wall. All fermentation rooms have engineered exhaust fans to evacuate CO₂ and replace it with fresh air. Instrumentation for atmospheric monitoring has been upgraded with new meters to monitor four gas elements.

"We have designated all spaces that could possibly have compromised atmospheres and difficult egress as Permit-Required Confined Spaces. These would include, but are not limited to, tanks, presses, and rotary fermentors. Every press and rotary fermentor has lock-out/tag-out controls to prevent operation when it is being cleaned."

Geyser Peak posts signage all over the hazardous areas (including on every fermentor) with illustration and text explanations of the dangers, and

the winery follows all OSHA guidelines on PRCS entries. Geyser Peak posts an attendant directly outside the PRCS during an employee entry. The attendant can have no other duties besides monitoring the entrant, and a *third* employee is on standby via radio in case of need.

Every employee undergoes a full day of safety training at the start of employment, and then attends annual refresher meetings. Munsell says the most common mistake employees make is to underestimate the dangers of confined spaces, so the refresher meetings are especially useful to reiterate the hazards.

Clos du Bois Winery

Clos du Bois Winery (Geyserville, CA) has a full time health and safety officer on staff: Melanee Southard. The winery is one of the most up-to-date on safety procedures and awareness. One

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Lock Out/Tag Out tag and padlock in position on controls of a rotary fermentor, preventing operation so Jesus Perez can safely make additions through the door on top of the fermentor.

concern Southard is currently managing is sulfur dioxide (SO₂).

In the fermentation rooms within the winery buildings, Southard says, "SO₂ is commonly used as an anti-oxidant. We have atmospheric tests on the various procedures where the use of SO₂ occurs. We do have, on-site, the capability to actually monitor the parts per million amount if a situation arises, and procedures that call for forced ventilation and/or the use of personal protective equipment by employees involved in the SO₂-use procedure."

Clos du Bois also monitors CO₂ in fermentation rooms. In tank rooms, the winery built a manifold system to carry CO₂ directly outside. In barrel rooms, Southard monitors CO₂ via a computer, which is programmed to activate the manifold system to evacuate contaminated air and replace it with fresh air whenever the environment reaches threshold limits. The system has a manual override, and the barrel rooms also have nighttime air fans operating regardless of air quality.

Winery Safety Video

A new safety video developed specifically for wineries is available. Produced in cooperation with U.C. Davis, the California Department of Industrial Relations, and Cal-OSHA Consultation Service (Research and Education Unit), the 20-minute video features Clos du Bois, William Hill, and Atlas Peak wineries (all Allied Domecq properties in Northern California).

"The Safe Winery, photographed entirely at working wineries, was developed as a safety awareness tool tailored to the wine industry's needs," says Jill Davis, a winemaker with 25 years' experience who consulted on the project. It is meant to help increase safety awareness in new employees and temporary workers, and for advancing safety awareness among all winery staff.

Incorporating winemakers, winery safety officers (including Melanee Southard at Clos du Bois), cellar workers, and maintenance staff, the video covers subjects such as general winery safety, confined spaces, chemical safety, electrical safety, fire, earthquake, lifting, and ladder safety.

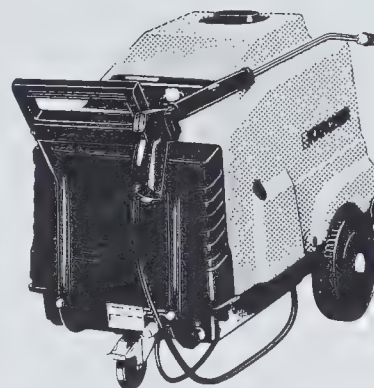
U.C. Davis enology staff and instructors also participated. The production team researched the marketplace (Internet, film and video distributors, wineries, college-level viticulture and enology programs, OSHA inspectors, and safety consultants) and found no wine-industry specific video addressing safety issues.

A vineyard safety video project is in production.

The Safe Winery is available in English (\$150), Spanish (\$150), or both languages (\$250) from Sonoma Mountain Productions, PO Box 1927, Glen Ellen, CA, 95442; tel: 800/931-5311; fax: 707/544-5311; website: www.sonomamountain.tv. ■



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EMPLOYEE SAFETY

Cleaning solvents and fumes are also atmospheric safety hazards, and Southard maintains employee safety around these substances by using ventilation fans and protective clothing and equipment as needed during cleaning tasks.

Tanks, presses, and sumps are among the confined spaces managed carefully at Clos du Bois. "We are very serious about this program. We have eight multi-gas monitors (at about \$2,000 each) to ensure that employees have the tools to do the entry safely," Southard says. "We also have an enforcement program that carries heavy disciplinary actions if procedures are not followed."

Employee education begins at orientation, when, depending on their job, employees receive between one and 20 hours of training. All new hires undergo further training under their department heads. Next, weekly train-

ing sessions address specific concerns pointed out by an employee or department. Finally, departments rotate the hosting of monthly training sessions until all annual refresher training issues have been addressed. Then the cycle is repeated.

Employee training often includes the need to train outside contractors. Southard requires a written copy of PRCs procedures from any contractors, and if they have no program, their workers are trained to Clos du Bois standards before work begins.

Required signage is everywhere. Compliance-related items are posted in break rooms and near time clocks. Task-specific information is posted where the work occurs. Bold PRCs signage is posted on every confined space needing permitted entry.

Clos du Bois policy allows no one to perform production duties alone. The winery's PRCs entry policy requires a

minimum of three employees, and since the winery has a large trained staff, crews of up to 14 members are often working in the area if needed.

Southard reports that the last OSHA inspection at Clos du Bois occurred in 1998. "The inspection included a facility walk-through, looking for violations, such as unmarked chemical containers, out of compliance ladders, and improperly stored personal protective equipment.

"Employee interviews were conducted, inquiring about the winery's training programs and working conditions. OSHA reviewed our policies/procedures, training records, and the recording of industrial injuries on the 200 log." (As of 2002, that log became Form 300 for noting workplace lost-time illness or injury.)

Southard notes that the most common employee mistakes are poor housekeeping of an area, not letting supervisors know when they are unsure of a procedure, and taking short cuts. "Employees who have been with the winery for a long time become complacent about jobs, and their attention is lost," she notes. "This most often ends in an injury or property damage."

When asked what the most common employer mistakes are, Southard replies, "Not understanding the laws, not bothering to learn them, and not utilizing the many services available to employers to protect employees and winery interests. Safety needs to be very much a two-way street, with open lines of communication between employees and the employer."

Also, the employer needs to listen carefully to employees. "Employers need to track, acknowledge, and respond to near misses or minor incidents, as they are the indicators for potentially disastrous situations that are yet to come," she warns.

Both Munsell at Geyser Peak and Southard at Clos du Bois recommend that employers take advantage of OSHA's consultation service. Without risk of triggering an OSHA inspection, wineries can contact OSHA for an educational audit visit that is extremely useful. Also, Southard makes frequent

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use of Cal-OSHA's Title 8 home page, www.dir.ca.gov/counters/t8index.htm.

New Regulations in 2000

Stephanie Rhine at EORM says that Cal-OSHA has additional "teeth," since new legislation was passed that went into effect in 2000. The legislation, AB 1127, significantly increased penalties to employers who do not comply with the Cal-OSHA regulations, to include fines up to \$70,000 and jail time. It also changed the standards regulating confined space work. It also changed the "suggestion" that companies working together at a site (such as outside contractors on-site at a winery) cooperate on safety issues, to a rule that allows OSHA to cite all employers at a single work site if any one of them is performing unsafe activities.

Section 5157 of the Title 8 regulations, the section specifically dealing with Permit-Required Confined Spaces,

was changed by AB 1127 to embody stricter standards (paraphrased here by Rhine):

- Employers must ensure that all permit-required confined spaces are labeled and all workers are trained and informed that these spaces are not to be entered without proper authorization.

- If an employer chooses to have employees enter these spaces, there must be multiple controls put in place. These include a written program document, trained persons, special equipment, and a rescue and emergency service.

- If an employer chooses to contract-out the work, the employer must be assured that the chosen contractor meets Cal-OSHA requirements.

"Training cannot be stressed strongly enough," says Carol Morrill of CM Consulting (Healdsburg, CA). "Training should never be a backburner issue. It needs to be an impor-

tant aspect in the winery's annual budget plan. Management needs to stress and train *constantly* on the importance of following safety procedures for confined spaces exactly."

Safety issues are complicated, tedious, and potentially dangerous. But if wineries are willing to spend time working at it, safety consultants and OSHA stand ready to help. If you are not clear on OSHA safety guidelines or how to implement the procedures your winery should have in place, contact one of these resources to educate yourself and your employees. Ultimately, every confined space accident or near-miss stands as testimony for the power of prevention. ■

Resources

PWV thanks all participating wineries, Cal-OSHA for its excellent website resources (http://www.dir.ca.gov/occupational_safety.html), and the following safety consultants for their help with this report:



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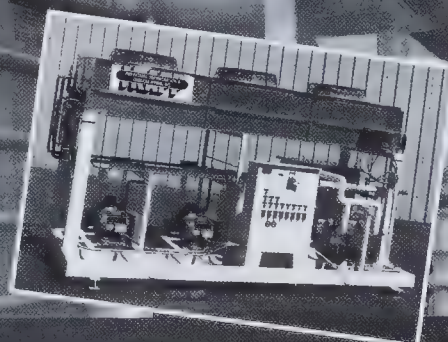


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EORM, Stephanie Rhine, 283 E. Java Dr., Sunnyvale, CA, 94089; tel: 800/648-1506;

fax: 408/822-8001; e-mail: rhines@eorm.com.

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Grappling with Mealybugs

Continued from page 14

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Powdery mildew forecasts & maps go online in western U.S.

BY Carla Thomas, FieldWise, Inc.
Dr. Doug Gubler, Professor
Department of Plant Pathology,
University of California, Davis

In 1995, the University of California grape powdery mildew disease model (also known as the Gubler-Thomas model) was implemented in a landmark cooperative venture between private industry, growers, the UC Davis Department of Plant Pathology, UC Cooperative Extension, and the UC Statewide IPM Program.

The model was developed during an eight-year project conducted by Dr. Doug Gubler and Carla Thomas at University of California, Davis, Department of Plant Pathology. Once the model was developed, it needed to be validated in commercial vineyards.

The program was established to validate and implement the model in commercial vineyard operations. It is important to validate the model to be certain it applies to a wide variety of commercial settings.

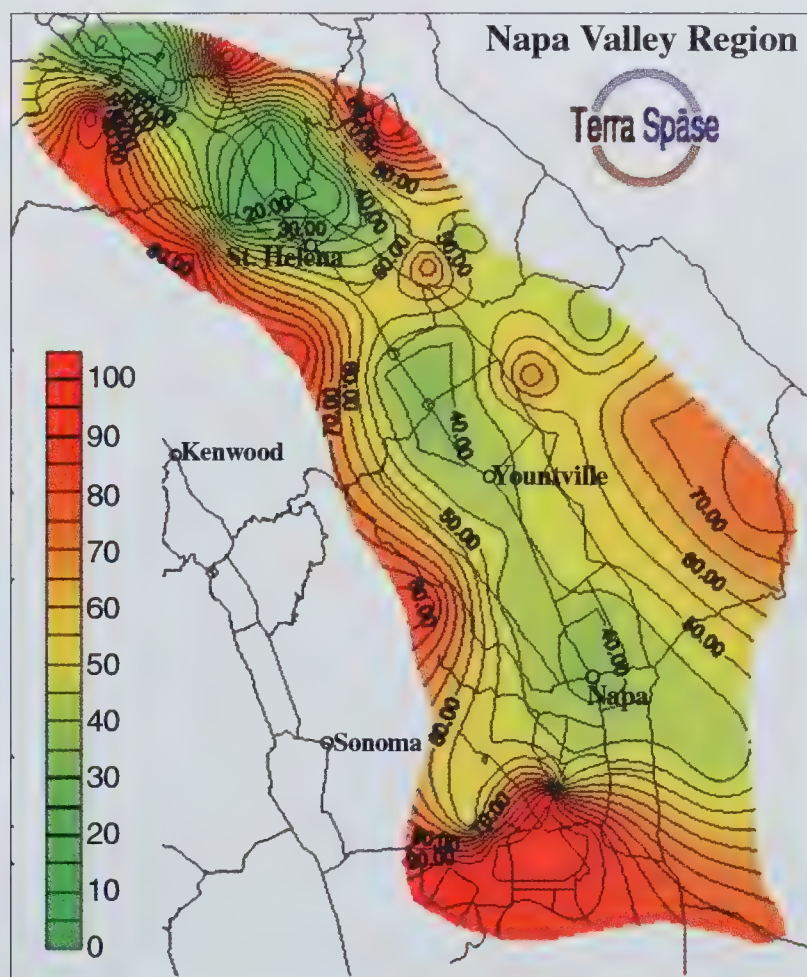
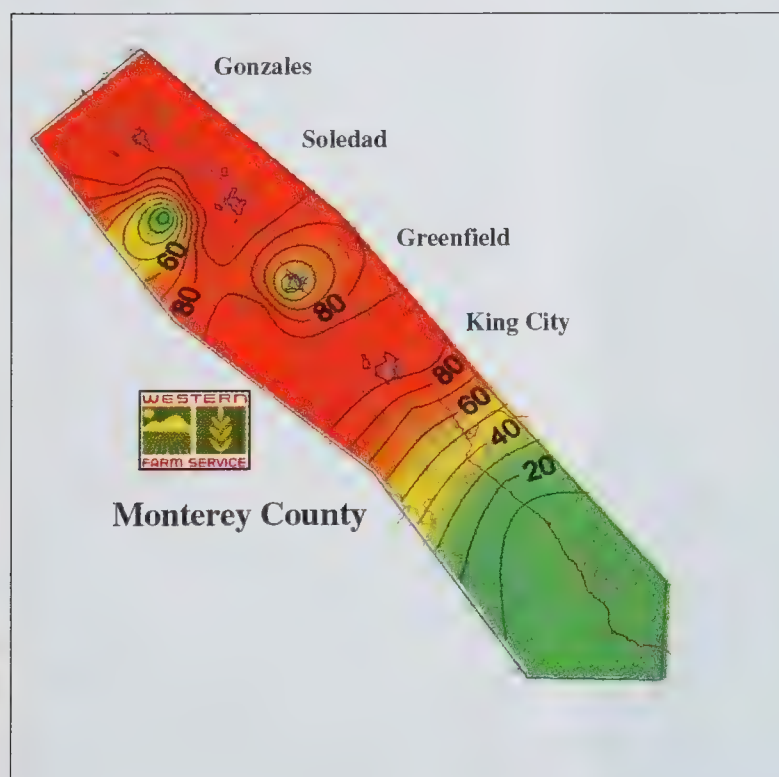
Timing of the project was ideal, since Adcon Telemetry was introducing a major improvement in weather station technology to California. (Adcon Telemetry is an Austrian company with offices around the world, including Santa Rosa, CA.) The weather stations are fully automated, using solar power and radio telemetry to collect weather information, process it through the powdery mildew model and distribute results to growers on a 24/7 basis. This capability

greatly facilitated distribution of information in many locations to many people.

The cost of weather station equipment was shared between growers and the UC statewide IPM program. Scouting services to document validity of the model were paid for by growers, and were conducted by UC Cooperative Extension staff in three counties (Napa, Sonoma, and Kern). Growers and Adcon Telemetry paid for training and weather network maintenance. The base station radio receivers that collected the weather information were housed in UC Cooperative Extension offices.

The powdery mildew model, based primarily on temperature and leaf wetness, was successful in predicting when sprays were needed. By the end of 1995, the number of growers using the program had grown from 25 to 50.

Use of the powdery mildew model has reduced the number of fungicides sprays in some vineyards. In some cases, the number of sprays was not reduced, but the timing was changed.



Maps showing daily powdery mildew risk index, ranging from low (green) to severe (red).

WINEGROWING

Online Access

Regional powdery mildew risk maps can be accessed for Napa County, Sonoma County, Sacramento Valley, Stockton/Lodi/Walnut Grove, Merced/Madera, Fresno/Visalia, Kern County, Monterey County/Gilroy, Paso Robles/Santa Maria, and Imperial Valley at www.gowanco.com or www.agdecision.net (need to contact a WFS fieldman to obtain access to www.agdecision.net). The five-day powdery mildew forecasts for the Sacramento Valley, Stockton/Lodi and Monterey area can be accessed at www.fieldwise.com. Powdery mildew risk maps and five-day forecasts for Napa and Sonoma Counties can be accessed at www.terrapase.com.

TerraSpase, Inc. is a GIS company in St. Helena, CA, that provides vineyard

establishment and management plans. It offers sponsored regional risk products for wine grapes and site-specific weather and crop risk subscriptions and five-day disease forecasts for Botrytis and powdery mildew in Napa and Sonoma counties.

FieldWise, Inc., is an agriculture information company that provides weather-based crop risk products through sponsored regional products and site-specific weather and crop risk subscriptions for grapes and other crops in the Sacramento Valley. It also offers disease risk forecasts for areas of California outside of the north coast and soon will expand these products to include Oregon and Washington (www.fieldwise.com).

Western Farm Service (Fresno, CA) is a full service agrichemical distributor in California, Washington, Idaho, and Oregon. It provides risk maps and site-

specific subscriptions for areas south of Sacramento and San Francisco (www.agdecision.net or www.westernfarm-service.com).

Wilbur-Ellis Co. is an agrichemical distributor in California, Washington, Idaho, and Oregon. It provides risk maps and site-specific subscriptions for Washington from its Yakima, WA, store (www.weco.com).

Bayer Crop Science (Research Triangle Park, NC) is the supplier for Flint and Elite powdery mildew control products and will be sponsoring the five-day powdery mildew forecast for the Stockton/Lodi area and Monterey County at the FieldWise web site or on its own website (www.bayercropscience.com).

Gowan, LLC, (Yuma, AZ) is the supplier of Rubigan and will be sponsoring the grape powdery mildew maps for all of California (www.gowanco.com).



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The model estimates the favorability of weather conditions for development of disease.

When conditions for disease are very favorable, the powdery mildew model suggests that sprays should be applied at frequent intervals. When conditions for disease are less favorable, it suggests that sprays can be applied less frequently, stretching the time between sprays proportionally to the favorability of weather conditions for mildew development. Thus, the model was able to reduce the number of sprays needed in some vineyards by increasing the spray interval during low risk conditions.

In other cases, the number of sprays may not have been reduced, but the timing was changed so that several frequent sprays were applied during high risk periods, but intervals between sprays were increased when risk was low. If the model had not been used to increase the frequency of sprays when risk was high, the amount of disease would have been higher during those periods. Thus, by changing the timing and/or number of sprays, disease control was achieved while using fewer or an equal number of sprays at intervals determined by the climate.

In 1996, the Napa and Sonoma networks were privatized. Terra Spase,

Inc., (St. Helena, CA) took over the base stations and began providing network support for the system on a fee basis paid by growers. The network had then grown to over 120 weather stations.

Western Farm Service (WFS), based in Fresno, CA, purchased base stations and more than 500 weather stations in 1996, and it established networks in California including areas south of Sacramento and San Francisco, and in Kern County. That network now has more than 2,500 weather stations.

In 2000, FieldWise, Inc. (owned by Carla Thomas) set up a weather network service in the Sacramento Valley with 52 weather stations.

Disease and insect models, as well as irrigation and crop growth models, have now been implemented in these regions and in other states for more than 20 different crops. There are currently more than 3,000 weather stations operating in these networks in the western U.S., with more than 2,000 in California alone. Western Farm Service provides network services in Oregon. Wilbur Ellis (Yakima, WA) services the network in Washington.

Initially, information provided by these weather networks was available using only proprietary software, purchased from the weather service provider. Service providers who run these large weather networks now use GIS/GPS technology to map crop risk. Today, regional maps that show crop risk in each area can be accessed on the Internet. The following paragraphs describe how it works:

Weather stations are located five to 12 miles apart throughout an area. Weather data are collected automatically from all of the weather stations within a region, then run through a crop risk model, such as the powdery mildew model. Then Geographic Information System (GIS) software estimates the powdery mildew index values for areas between the weather stations (interpolation).

Colors are assigned to show different risk indices. Green indicates areas of low powdery mildew risk (0 to 30 index points), yellow indicates moderate risk (40 to 50 index points), orange areas are high risk (60 to 70), and red indicates severe risk (80 to 100). If the

risk index is high to severe, it is appropriate to use fungicides at the shortest labeled interval. If the risk index is low, applying on the longest labeled interval is warranted. The intermediate risk level warrants an interval of an intermediate labeled length.

Since 2000, FieldWise and Terra Spāse have provided regional powdery mildew maps over the Internet at no charge to growers. The cost of producing these maps is paid by industry sponsorship of the information product. Maps showing regional disease risk index and weather conditions are updated daily. In 2002, Western Farm Service began to produce sponsored disease risk maps from selected regions of its weather network. In 2003, Western Farm service will produce disease risk maps for all of its service areas south of Sacramento and San Francisco.

Wilbur Ellis, an agricultural supplier and distributor in Washington, produces disease risk maps in

Washington as a grower service and is hoping to obtain sponsorship for its products in the future. Western Farm Service in Oregon also hopes to obtain sponsorship for its disease risk maps.

Through these services, and with industry support, regional maps of the grape powdery mildew risk are available free for all California grapegrowing regions except the Sierra Foothills (where there is no service provider) and Mendocino County (where maps are on a fee-only basis).

In 1997, Fox Weather began collaborating with the authors of this report to provide a five-day forecast for the powdery mildew risk index. The forecasts have proven to be 60% to 90% accurate in a wide range of locations. The variation in accuracy depends on location and how many days in advance the forecast is predicting. Generally, the forecasts are 75% to 95% accurate when forecasting up to three days in advance. Forecasts four to five

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WINEGROWING

days in advance are usually 55% to 85% accurate. Topography and proximity to the coast are the primary factors affecting the powdery mildew forecast accuracy.

The forecast error is usually in predicting which day a significant change in disease risk is likely to occur, not

whether the change will occur. A jump in the risk index can be predicted with great accuracy, but pinpointing the exact day it will happen is more difficult. Whether a jump occurs as forecasted or a day later, growers still benefit from knowing the crop is at greater risk. This is especially important for the use of pre-

ventative fungicides, which are more effective if the material is in place before the protection is needed.

Bayer Crop Science (Research Triangle Park, NC) has agreed to sponsor California powdery mildew forecasts on the Internet in 2003 for Monterey County and the Stockton/Lodi region. It is hoped that additional sponsorships will make powdery mildew five-day forecasts available soon. Gowan LLC (Yuma, AZ) has agreed to sponsor California powdery mildew risk maps for 2003. Maps and forecasts will be posted daily, seven days each week from April 1 to September 30. Similar products may be available for grapes in Oregon and Washington through sponsorship.

California Internet disease risk maps will be provided by region. The regions will be: Napa County, Sonoma County, Sacramento Valley, Stockton/Lodi/Walnut Grove, Merced/Madera, Fresno/Visalia, Kern County, Monterey County/Gilroy, Paso Robles/Santa Maria, and Imperial Valley.

Regional powdery mildew maps and forecasts complement each other. The regional risk maps tell growers what the risk for powdery mildew development is today; the forecasts tell what it is likely to be for the next five days. Growers can access the forecasts, schedule fungicide applications, then check the regional risk map to see if the forecasted values actually occurred — and make rapid adjustments if they did not.

The regional risk information will not be as accurate as having a weather station in individual vineyards. Regional risk products are intended to show widespread weather events, and may not show risk from site-specific cultural practices, such as irrigation or canopy management.

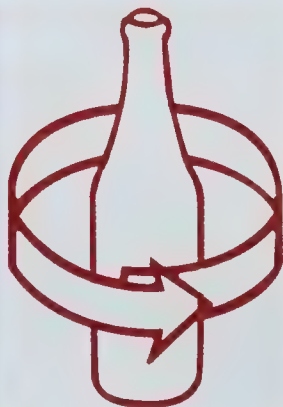
There is now no reason for growers in California not to use the UC powdery mildew model to time sprays, increase profitability, and improve environmental stewardship by applying fungicides only when needed.

In the future, the authors will collaborate with Dr. Gary Grove at Washington State University and Dr. Walt Mahaffee, USDA, Corvallis, OR, to improve the powdery mildew model by incorporating refinements in the way it uses humidity and high temperature readings. ■

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Mourvèdre earns a serious look

BY Eleanor & Ray Heald
Contributing Editors

Morphed from the name Mataro in California to the more universal moniker Mourvèdre, this grape variety has entered an era of renewed enthusiasm. Revived interest on the part of a handful of producers has preserved California's oldest vines and caused other wineries to look seriously at newer clones now available for planting.

Once widely planted in California in the early 1900s, Mourvèdre acreage suffered near terminal meltdown to just under 300 acres by 1997. Although only minimal planting has occurred since then, some winery-merchants of dreams refuse to become morticians of the variety.

Born in the Bandol area in the French region of Provence, Mourvèdre is a mainstay of southern Rhône Valley red blends, such as Côtes du Rhône and Châteauneuf-du-Pape. Spain, how-

ever — where it is known as Monastrell — grows the lion's share.

From junior blending partner in the Mediterranean regions of Europe, it became part of a renowned trifecta when Barossa Valley and McLaren Vale producers in Australia began making highly touted blends of Grenache, Shiraz, and Mourvèdre.

In warmer growing regions with cool nighttime temperatures and on stony or well-drained sandy soils, when Mourvèdre performs well, it yields ripe, non-astringent grapes with mature and round tannins.

Deeply-colored wines range from medium- to full-bodied, bursting with juicy berry and black plum fruit, accented by leathery, spicy, and intriguing gamey notes.

On the flip side, Mourvèdre is challenging to grow. Frequently, yields can be irregular. Without significant growing season variation, one year with satisfactory yields and color, may be succeeded by a poor one. Vigor and

time of ripening, however, appear to be site-dependent. Young vines can take as long as 10 years to provide good concentration. This fact has sent some California devotee producers in search of old vines sources.

A prime example is the head-pruned and dry-farmed Bridgehead Vineyard, west of Oakley, CA. Although a part of this vineyard was planted in 1878, the majority of vines are 90 to 100 years old and exhibit low vigor. It was purchased in 1997 by Cline Cellars for its Ancient Vines Mourvèdre.

In the early 1990s, Philip Staley (Philip Staley Vineyards & Winery) first planted Mourvèdre for blending. Over the years, he found that in one in three years, the wine was delicious when blended with a small percentage of Grenache.

Major attraction

Mourvèdre offers consumers looking for new tastes something different,

VARIETAL REVIEW

Jeff Cohn (Rosenblum Cellars) believes. "I'm a Rhône wine fanatic and these wines are ideal food matches. They open my mind to what I'd like to eat with them — any food that's grilled or roasted. Venison is great. Lamb is wonderful.

"I never feel like I have to be dressed up for some occasion to open a Rhône-style wine like Mourvèdre. I do feel that way with Cabernet Sauvignon."

Ed Killian (Chateau Souverain) adds, "Mourvèdre is another flavor on the palate, and that's why we bother to produce it from a two-acre vineyard, that was originally intended to make a blending wine for a Syrah program. It has a special draw and affinity for food."

In the early 1980s, winery owner Fred Cline, saw Mourvèdre grapes selling for a low price and going into large generic blends. He had spent summers with his grandfather in Oakley and they made wine from the local grapes and he knew how special the grapes

were. Cline Cellars released its first Mourvèdre in 1984 and now over 100 acres of Mourvèdre are harvested from 12 different Contra Costa vineyards.

Clonal selections

For vineyards in California it is best to reference field selections, which are vineyard cuttings that may be mixed genetic plant material. Many cuttings came from Oakley, CA, one of Mourvèdre's last stands in the state. It is believed that most old vineyards in and around Oakley were propagated from the budwood brought to the area originally in the 1870s. Today, ENTAV-INRA and the Tablas Creek certified Beaucastel clonal material have been planted in the Paso Robles, CA, area.

Lou Preston (Preston of Dry Creek) notes that the budwood source of his 10-year-old vines was Mount Veeder Vineyard in Napa Valley.

Most of the Cline vineyards were planted 80 to 100 years ago and the bal-

ance were planted 20 years ago. "Mourvèdre is on its own roots and has probably remained healthy by virtue of the well-drained, sandy soil," reports Charlie Tsegeletos.

Cohn cites a two ENTAV-INRA clonal experiment (369 and 233) with John Caldwell (Caldwell Nursery, Napa, CA) at Charlie Rominger's vineyard in Solano County. Although the vines are vigorous, the berries are smaller than those on vines in Contra Costa County sourced by Rosenblum Cellars.

"Initially during fermentation of the experimental grapes," Cohn remarks, "there was little color and then it appeared in a matter of a few hours. A dark, rich wine resulted. The following year, the wine was less desirable. We want to experiment more with the 16 registered ENTAV-INRA clones, but we need them to be consistent."

Vigor

In Staley's 3.5 feet deep, gravelly-loam soil vineyard (on the outskirts of the Russian River AVA on Westside Road), most vines are planted on 5-C rootstock — something Staley would never do again, he reports, because of poor response to water stress. The vineyard is in a marginal area, where in only one of three years, Mourvèdre gets what he calls "dead ripe." To have character worth talking about, the grapes need to shrivel and attain 25.5° to 26° Brix but that doesn't occur until late October or early November.

"If 5-C gets water-stressed late in the growing season," Staley adds, "it doesn't respond, no matter how much water it gets." To plant Mourvèdre in sites like his, Staley recommends 110-R.

At Chateau Souverain, Jerry Quirk notes, the vines are planted on 039-16 rootstock, which is vigorous. The vineyard lies on a hill shelf with rocky, volcanic, clay soil, about 150 feet above the Russian River in Alexander Valley. In this location, Mourvèdre is devigorated on a simple T-trellis.

"The soils around Oakley are amazing," says Tsegeletos. "They are so sandy that you can imagine that you are standing on a beach. The sand is more than 20 feet deep in some vineyards. Average rainfall is about 10 inches per year and our Mourvèdre is

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dry-farmed so excess vigor has not been a problem."

All participants agree that Mourvèdre requires a warm, Mediterranean (with low rainfall), Region III climate. "That typifies," Killian contends, "the warmer areas of Alexander Valley and the southern Rhône Valley in France, where getting ripeness is not a problem."

Canopy manipulation

At Chateau Souverain, minimal canopy manipulation of Mourvèdre on a T-trellis in rows with east-west orientation involves leafing on the north side. Canes stop growing at four feet in length and hedging is unnecessary.

"Cline vineyards are head-trained with 5 or 6 arms," says Tsegeletos. "Vines are spur-pruned, leaving two buds per spur and usually two spurs per arm. Mourvèdre canes seem to grow straight up with less droop than Zinfandel and one can actually see through the canes and look at the grapes which are not obscured by canopy."

The afternoon wind blows through Oakley as it is funneled into the Central Valley and the canes on the head-trained vines, having no wires to attach to, can take a beating. Vineyard manager, Allan Lucchesi, told Tsegeletos that when he was irrigating new vines, to establish the roots, they were more susceptible to wind damage, and now that they are dry-farmed, they are more resistant to breaking in the wind.

Staley reports that his young vines (11 years old) require minimal shoot thinning, and it is the only red variety that does not require hedging because of vertical growth, well-managed with VSP.

Yields

Although planted on St. George rootstock at Preston of Dry Creek, shallow clay soils devigorate Mourvèdre which attains ripeness every year. "Yet," Preston maintains, "if yields are too high (more than 11 to 12 lb/vine), the grapes never deliver good color or desired flavors."

With modern VSP trellis systems, Quirk suggests that expression of yields in lbs/vine or tons/acre is less meaningful. "What we like to see in a vineyard," he explains, "is a cordon with spurs evenly spaced and two

shoots/spur. Basically, if the vine is in balance, the crop should take care of itself. Depending on the soil, the crop level might be 3 tons/acre or even 6 tons/acre (TPA)."

From Rosenblum's Contra Costa County, old-vine vineyards, yields are 5 to 8lb/vine maximum.

"Cline averages 1.5 to 2.5 TPA on the old vines and 4 to 5 TPA on the newer plantings," reports Tsegeletos. "At this pruning level, we began harvesting 2002 Mourvèdre on August 25 at 24° Brix and ended on October 16."

As with Zinfandel, according to Killian, clusters on the same vine can vary in size and appearance. Uneven coloration and erratic ripening are also common. To insure more even ripening at harvest, a green drop is routine at veraison to retain clusters that are in the same physiological ripening zone. With this practice, yields are about 6 TPA.

"One of the impacts of Mourvèdre's natural vigor," notes Preston, "is that a

significant number of fruitful basal buds push. Ripening of bunches from these buds is out of sync with the rest of the vine."

Staley's vines are spaced 6x9 with a VSP trellis naturally bearing 6 TPA. But to attain ripeness, vines must be cropped down to 2.5 to 3 TPA.

Ripeness indicators

Cohn looks for black cherry, licorice flavors, and some peppery notes in ripe Mourvèdre.

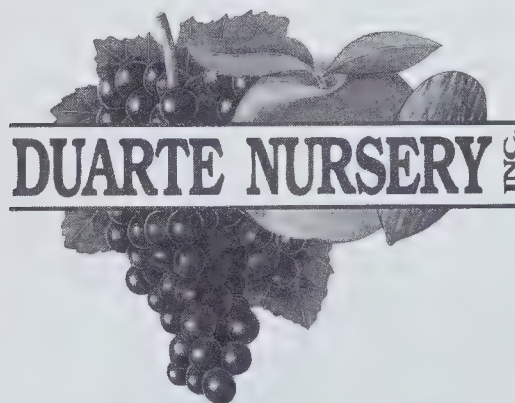
Killian watches for flaccid berries, but not raisins, with flavors of ripe plums and other spicy black fruit characters.

"At Cline, we look for a cherry and plum character and ripe seeds," explains Tsegeletos. "Once the berries begin to shrivel, the sugars can jump a half a degree per day."

"In my vineyard," Staley contends, "I want the berry shriveling on the sun side of the berry. I don't even begin sampling

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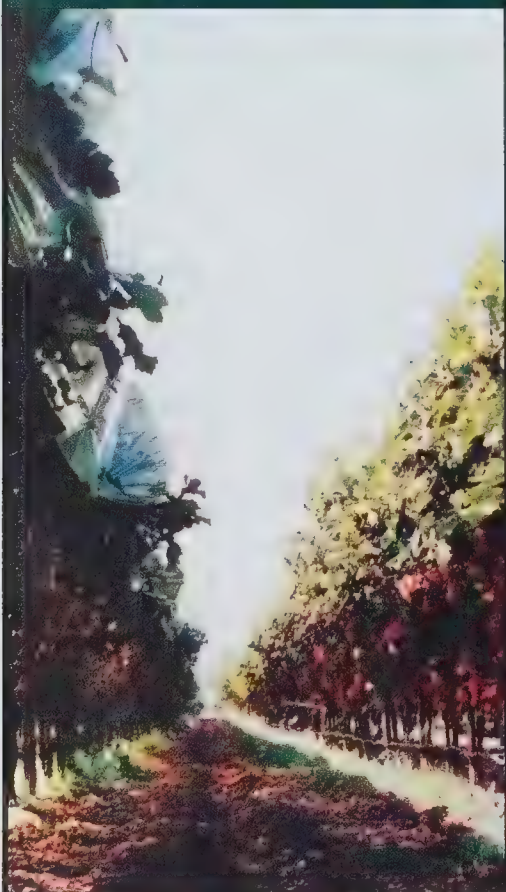
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until I see that. Then I also look for ripe plum and blackberry flavors."

To Tsegeletos the cherry and plum characters were evident in the grapes. In addition to the fruit character of the grapes, once the fermentation was underway, dark chocolate, mint and herbal characters emerged.

Plum and black cherry fruit at ripeness open to leather, herbs, and tobacco-like characters in the wine, notes Preston, who recently has begun to focus more on seed maturity. "Pulp and seeds," he says, "retain green flavors until ripeness. So, we're looking for that 'crunch' and taste when sampling. In some years, the fruit gets 'sugar-ripe' much too early. By the time flavors develop and seeds no longer taste green, there is significant softening of berry skins."

Acidity and phenolics

At Cline, grapes are typically harvested with good acid at 0.73 TA and a pH of 3.6. Acid is adjusted to taste once the wine has completed MLF and blending begins.

Killian suggests Mourvèdre requires pH correction after malolactic fermentation (MLF). Corrections for high pH are made during fermentation, but they are not taken the whole way early on. "We leave ourselves some room for adjustment," he admits. "Acid is easy to put in but it's hard to remove. Unless a winery wants to conduct sophisticated analysis, measuring potassium ion (K⁺), tartaric, and malic acid levels, complemented by a number of calculations, it's simpler to adjust again after MLF.

"During fermentation of Mourvèdre, the yeast are already challenged by alcohol at 15% or higher. We try to avoid additional acid challenges when we're trying to get MLF to complete.

"Flavor balance and longevity of the wine are always the primary considerations for acid adjustment. Phenolics, which are pH-sensitive, need to be in the correct zone. Color is also affected. I'd rather have pH than acidity on the high side. All that matters in the end is that the wine tastes good."

"In terms of phenolics, our Mourvèdre is fairly soft with low levels of tannin," reports Tsegeletos. "We ran a phenolic profile on some of our fermentations this

year and it showed that the grapes had polymeric phenol content on the low side when compared to an average Cabernet Sauvignon value — as obtained by ETS labs in St. Helena, CA."

Early fruit handling

Although the majority of participants have pulled the rollers from their crushers to only destem and achieve 15% to 20% whole berries, Staley ferments nearly 60% to 65% whole berries and 10% whole clusters.

At Cline Cellars, once the fruit is destemmed and pumped into the fermentor, the jackets are set at 65°F for 48 hours. "This scrubs off the field heat and allows us to start the fermentation slowly," explains Tsegeletos.

At Rosenblum, a pre-fermentation maceration extends to three days at 50°F.

Some participants use Pasteur Red yeast culture while others, like Killian, prefer alcohol tolerant D-254, isolated from the Rhône Valley. "It seems to help maintain fruit flavors," he reports. "For Mourvèdre, it's a solid yeast that does not reduce color."

"We use Pasteur Red for most of the Cline lots," explains Tsegeletos. "But for any fruit over 26° Brix, we use the more alcohol-tolerant Prise de Mousse.

"When I have done yeast trials in the past, the flavor differences disappear three or four months after fermentation and it's hard to tell the difference that one yeast makes over another. Yeast performance factors like alcohol tolerance and fermentation rate are important to us with high sugar Mourvèdre."

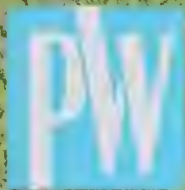
Cohn prefers D-80 for its ability to accentuate the black pepper quality of Mourvèdre. Lallemend Syrah yeast is also good. "I believe the yeast culture makes aromatic and flavor differences," he contends.

Participants all add about 30ppm SO₂ to grapes at the receiving hopper.

Fermentation

At Cline Cellars, three pumpovers per day are routine. Early pumpovers are manual, then an automatic irrigator is used later during fermentation. As alcohol builds, the first and last pumpover are automatic, complemented by three

Continued on page 74



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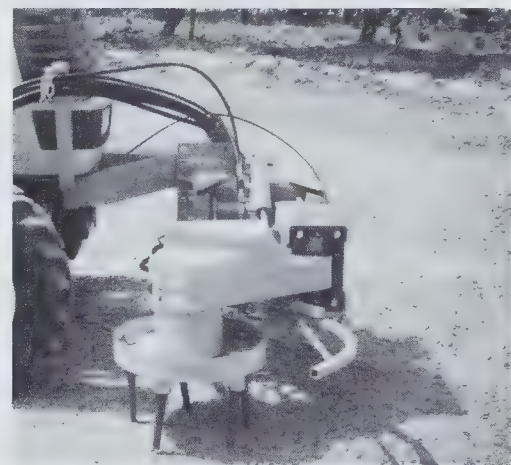
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PO Box 843, Culpepper, VA 22701

tel: 540/825-5700; fax: 540/825-5789

e-mail: bernd@euromachinesusa.com

West Coast:

4950 Fulton Dr. #E, Cordelia, CA 94534

tel: 707/864-5800; fax: 707/864-5879

e-mail: mattateuro@aol.com

PLEASE SEE EURO-MACHINES' AD, PAGE 30.

OXBO INTERNATIONAL CORP.

OXBO is the exclusive U.S. distributor for GreenTech vineyard spray equipment. In addition, OXBO is developing mechanized equipment under the Morris-Oldridge system from the University of Arkansas for pruning, fruit thinning, and shoot thinning.



The GreenTech product line includes single and two-row vineyard sprayers in trailer configuration. A three-row model can be mounted on OXBO's dedicated over-the-row tractor, the Freedom Series 2200FS, with a 7ft.8in. crop clearance, or mounted on a self-propelled harvester chassis.

GreenTech Vineyard Spray Systems utilize unique electrically driven prop-style combination fan/spray heads to deliver a high volume of air, creating tremendous leaf turbulence and a more efficient, complete application.



OXBO has opened a new service center in Selma, CA. The company is a worldwide provider of specialized harvesting equipment for citrus, vegetables, and seed corn. OXBO also sells and services high-clearance and floater equipment for both liquid and dry application.

For more information, contact:

OXBO International Corporation

tel: 559/392-1341

e-mail: grapeinfo@oxbocorp.com

website: www.oxbocorp.com

PLEASE SEE OXBO INTERNATIONAL'S AD, PAGE 44.

FERRARI TRACTOR CIE

Ferrari Tractor offers the all-new Ferrari Cobram vineyard tractors.

Ferrari Cobram tractors are available in 35-hp or 45-hp and include new features such as 12-by-12 speed transmissions, inboard wet-disc brakes, water-cooled green three- and four-cylinder engines and even the option of bi-directional operation. The new designs retain the low profile, equally sized, four-by-four drive wheels in narrowly configured articulated models and the option of wider models with front-axle steering.



The Cobram 50AR produces 46-hp in a tractor as narrow as 40-inches wide with weight distributed equally on all four drive wheels. The tractor is able to operate equally well with tools behind the driver or in front, where monitoring tool function is easiest. Operators can shred and mow without first running over debris, and hedging, leaf blowing, and in-row cultivation are more precisely done by rotating the driver module 180°, which takes only 10 seconds.

The tractor's low center of gravity and equal weight distribution over its four full-time drive wheels provide maximum traction and stability, and when combined with oil bath disc brakes, maximize safety and performance.

At \$26,000, the Ferrari 50AR Reversible is many thousands of dollars lower in cost than any comparable performer.

For more information, contact:

Ferrari Tractor CIE

PO Box 1045, Gridley, CA 95948

tel: 530/846-6401; fax: 530/846-0390

WEED BADGER DIVISION

Since 1979, Weed Badger Division has manufactured a full line of rugged, commercial-duty hydraulic, rotary vineyard tillers and mowers. More than 10 upgradeable Weed Badger models are cost-effective tool carriers for a variety of attachments including the Model 3875 Mower, Sweeper/-Tiller, Badger Broom, Cyclone Spade, and more.



Weed Badger's high-speed precision, in-row rotary tillers are an economical alternative to chemical weed control, hand labor, or flaming. It is the only tool of its type to kill big weeds while conditioning and aerating soil, resulting in optimum water penetration. Weed Badger machines hill-up and hill-down soil and incorporate soil amendments while controlling weeds. Weed Badger kills all weeds including Johnson and Bermuda grass and tough, herbicide-resistant weeds and eliminates hassles, risks, and liability concerns for potential exposure involving workers, area residents, and growers nearby. Eliminate trash habitat under the canopy where disease-carrying insect pests and rodents overwinter. Weed Badger is a top choice for conventional grape growers, IPM programs, organic growers, and research centers.

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For more information, contact:

Weed Badger Division Town & Country Research & Development, Inc.

5673 SE 95 Ave., Marion, ND 58466-9718

tel: 701/778-7511; fax: 701/778-7501

e-mail: weedbadg@drtel.net

PLEASE SEE WEED BADGER'S AD, PAGE 23.

WADE RAIN MICRO IRRIGATION

The Pulsator, one of the Wade Rain family of irrigation products, provides **frost protection** and **cooling** at drip-flow rates for vineyards. Its low flow rate makes it an ideal choice for frost protection in vineyards with drip irrigation. For new installations, the Pulsator's unique features make it a logical choice for both cooling and frost protection.

Most drip systems provide sufficient water per acre to supply a Pulsator Frost Protection and/or Cooling System, using no more water than is normally supplied to a typical irrigated vineyard (1 GPH/vine). Because the water is concentrated in a narrow band over the cordon(s), application rates equivalent to a conventional overhead sprinkler system are obtained while enjoying tremendous water savings. The cost of large reservoirs, pumping plants, additional mainlines, and impact sprinklers are eliminated.

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- Generates a 15% reduction in plant temperature in 10 minutes.
- Offers direct conversion of existing drip systems.
- Applies water continuously to vines — unlike 30 to 45 second intervals for impact sprinklers.
- Reduces soil saturation and runoff.

For more information, contact:

Wade Rain Micro Irrigation

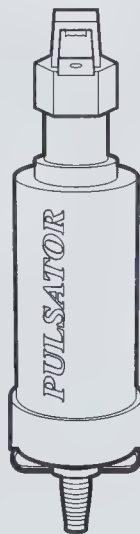
Tony Pereira

2851 E Florence Ave., Fresno, CA 93721

tel: 559/485-7171; fax: 559/485-7623

e-mail: tpereira@waderain.com

website: www.waderain.com



NTech® INDUSTRIES, INC.

Saving money on chemicals, reducing labor costs, and protecting the environment are the main reasons why leading growers use the WeedSeeker® Automatic Spot Spray System from NTech® (formerly Patchen, Inc.), to control weeds in their vineyard. It sprays only weeds, not bare ground or dirt, reducing chemical use up to 80%.



The WeedSeeker® system is designed to spray at speeds up to 10 mph. The system is incredibly more cost-effective and efficient than conventional spot-spraying or broadcast-spraying methods. With a WeedSeeker® system, one operator can move twice as fast down a tractor row as a conventional two-man spot-spraying crew.

The WeedSeeker® vineyard system is easy to use and can be mounted on an ATV, a tractor, or a variety of utility vehicles. The sensors are mounted under hoods on spray booms to protect the vines from drift. The system is used to spray berms and middles and can also be used to control vine suckering.

A leader in agricultural technology, NTech® Industries offers growers worldwide the solution to the age-old problem of weed control that is environmentally-friendly and saves money.

For more information contact:

NTech® Industries, Inc.

740 South State St., Ukiah, CA 95482

tel: 888/728-2436; fax: 707/467-3750

website: www.weedseeker.com

STIHL

No matter what the job is, the choice of a trimmer or brush-cutter comes down to two things: power that's dependable and construction that's durable. You want landscaping equipment that is super tough — tough enough to cut through heavy brush and thick grass on the first try. And you want tools that will last season after season.

STIHL®

STIHL has introduced the FS 250 and FS 250R, two unstoppable machines prepared to dominate those demanding tasks. Both are powered by 40.2cc Quad Power™ engines constructed with four transfer ports for extreme power and incredible fuel effi-

ciency. These high-torque machines are made to cut through the tough stuff without slowing down. Included are STIHL's exclusive EASYSTART® system with ElastoStart™ shock-absorbing starter handle, IntelliCarb™ compensating carburetor, and a solid-steel drive shaft.

STIHL manufactures the world's largest selling brand of chain saws and portable, hand-held, cut-off machines and a complete line of powerful, lightweight, and versatile outdoor power equipment and top quality, precision hand tools. STIHL products are sold through independent servicing power equipment retailers from coast to coast.

For more information, contact:

STIHL Incorporated

tel: 800/GO-STIHL (800/467-8445)

website: www.stihlusa.com

PLEASE SEE STIHL'S AD, PAGE 15.

AUTOMATA, INC.

For 27 years, Automata, Inc., has supplied complete systems that can be used for real-time irrigation scheduling, pest management, and frost warning.

Automata's complete systems can be used for soil moisture and frost warning by locating different sensors strategically in the vineyard and having a computer activate an alarm. The data can be sent directly into your computer and stored and/or a message can be sent to your pager for particular conditions.

With Automata's Evapotranspiration (ET) and Crop Water Stress Index (CWSI) software, irrigation scheduling can be calculated from weather parameters and used to schedule the amount of irrigation required.

For integrated pest management, Degree Day Software and BUGCOUNT electronic insect-counting hardware can report the forecasted insect emergence and report to a computer giving a potential and real-time profile of insect activity.

You can rely on Automata's products to bring you the best in irrigation, frost, and pest management results.

For more information, contact:

Automata, Inc.

104 New Mohawk Rd., Ste. A

Nevada City, CA 95959

tel: 530/478-5882 or 800/994-0380

fax: 530/478-5881

website: www.automata-inc.com

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FILE N° 069

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Foil typography and texture are the key elements on this premium label. The vineyard designation is bright colored foil stamping contrast the delicate script type in black foil which is the centerpiece of this label. Each foil stamping is repeated in the unlabeled brand name that stands out against the printed texture background in this glue applied label.

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BIRD GARD/JWB MARKETING



Bird Gard/JWB Marketing sells the Bird Gard PRO series of digital, distress-call bird repellers. There's a model for three acres, one for up to six acres, and the MEGA PRO with a 200-watt amplifier and 20-speaker tower that covers up to 40 acres.

The Crop Gard PRO series uses harassment sounds for tough birds like linnets, mocking birds, and high-pressure from starlings and robins. Like the Bird Gard, there's a model for three acres, one for up to six acres, and the MEGA PRO with a 200-watt amplifier and 20-speaker tower that covers up to 40 acres. When combined, the two systems achieve results comparable to netting.

Bird Gard/JWB Marketing's exclusive visual scare product is the Scare Windmill. It uses a unique uv-light-reflecting paint on the blades to repel birds in a two-acre area. Recently, it was discovered that one-half of a bird's vision is within the uv-light range. Movement of the blades in the wind looks, to the birds, like the commotion of a flock of birds taking off in fright, which causes a chain reaction.

For more information, contact:

Bird Gard/JWB Marketing

101 Hurlbut St., Westwood, NJ 07673

tel: 800/555-9634; fax: 201/666-7581

e-mail: birdgard@ix.netcom.com

website: www.birdddamage.com

KORVAN INDUSTRIES, INC.

Korvan Industries, Inc., manufactures a complete line of self-propelled and tow-behind grape harvesters.

Each harvester comes with Korvan's ANTI-M.O.G. cleaning system. The three fans, located above drop zones, remove debris, leaving very clean grapes.

This year, Korvan challenges growers to pick grapes a new way, with its "Fingers." The Korvan 3216 harvester is available with optional Orbirotor® heads, which are rotary-style heads that simulate hand harvest in quad, bilateral, or even vertical trellis. They're some of the most gentle and versatile heads on the market today. These picking heads were designed to harvest whole, undamaged fruit, allowing the winemakers to crush the fruit, not the machine.

With Orbirotor® heads and ANTI-M.O.G. fans, this harvester is a cost-effective way to achieve the same quality as hand-harvested fruit.



With Korvan's quality dealers, you can be assured that there is a dealer near you who will provide year-round parts and service.

For more information, contact:

Korvan Industries, Inc.

270 Birch Bay Lynden Rd.

Lynden, WA 98264

tel: 360/354-1500; fax: 360/354-1300

e-mail: korvan@korvan.com

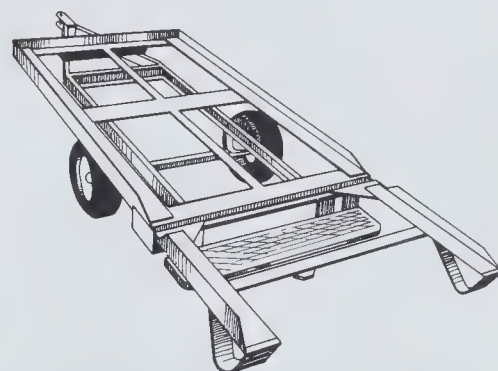
website: www.korvan.com

PLEASE SEE KORVAN'S AD, PAGE 59.

WESTERN SQUARE INDUSTRIES

Western Square Industries manufactures vineyard bins, trailers, and wine barrel racks.

Western Square's two-ton vineyard bins are manufactured in stainless or mild 14-gauge steel. The sides, end-walls, and bottoms are lap-welded to ensure strength and watertight integrity. The D-ring end is ribbed to transfer the stress of hoisting to the entire height of the bin end. Mild steel bins are powder-coated in a variety of colors with an FDA-approved, food-grade epoxy inside. These and other features ensure years of trouble-free use.



Western Square vineyard trailers are offered in six styles designed for narrow or wide vineyard rows. Trailer configurations accommodate two-ton harvest bins or up to three 4-by-4 plastic bins. Several styles are outfitted with ramps and plastic slides to drop bins without needing a forklift, facilitating a speedy return to the harvest. A new tilt trailer design eliminates the need for a hydraulic lifting mechanism. Simplicity of design and a durable powder coat finish contribute to easy maintenance. Add a 4-by-8 sheet of plywood and the trailer becomes a utility trailer for off-season projects.

All Western Square products are manufactured in America. For more information, call Trygve Mikkelsen at 209/944-0921.

For more information, contact:

Western Square Industries

1621 N. Broadway, Stockton, CA 95205

tel: 209/944-0921 or

inside CA: 800/367-8383

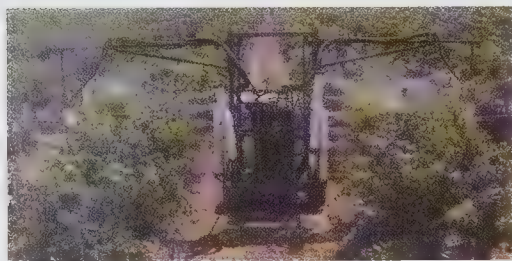
outside CA: 800/367-7810

website: www.westernsquare.com

PLEASE SEE WESTERN SQUARE'S AD, PAGE 27.

RANDELL EQUIPMENT CO., INC.

For 55 years, Randell Equipment has built quality sprayers for every need and prides itself offering the newest and latest technology.



From grapes to weeds, Randell Equipment has a sprayer for you. Whether you need a single- or multi-row electrostatic vine sprayer, a self-propelled herbicide sprayer, or something custom-designed, Randell Equipment has it all.

Randell Equipment's electrostatic sprayers deliver twice the deposition, with half the material, and eliminate run-off and drift, to save you money, time, and effort.



Randell Equipment's self-propelled herbicide sprayers will make spraying nasty weeds more efficient.

The next time you're looking for a sprayer, contact Randell Equipment.

For more information, contact:

Randell Equipment Co., Inc.

PO Box 777 / 296 E. Wutchumna Ave.
Woodlake, CA 93286-0777

tel: 559/564-3396; fax: 559/564-3051

PLEASE SEE RANDELL EQUIPMENT'S AD, PAGE 62.

EQUIPMENT THAT WORKS!

The Vineyard Auger is designed to mount on the side of a tractor and be operated from the tractor seat. It operates on eight gallons of hydraulic fluid per minute yielding 350 lb/ft of torque at 2,000 psi and drills a nine-inch diameter hole 12 inches deep.

The unit is available in two boom lengths. The short boom is 32 inches long with an extension of 12 inches and a total reach of 44 inches. The longer boom has a 40-inch stowed length with an extension of 18 inches for a total reach of 58 inches. Choose the length to match your vine row and tractor width.

Vineyard Augers are in use from Oregon to Georgia, California to New York. They can be operated from almost any tractor with adequate hydraulic flow. One user has it mounted on a crawler tractor in the center of the blade-mount on a pivot so that the unit can work on either side of the tractor.

The standard package includes a nine-inch diameter, 12-inch long auger mounted on a boom that will stow within the track of the tractor. The package also includes a three-section control valve that mounts on the floorboards of your tractor or on a platform extension if the tractor is too narrow for both operator and valve control. Up to 250 holes per hour have been reported. Literature is available upon request.

For more information, contact:

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tel: 800/242-4479; fax: 913/677-4614

PLEASE SEE EQUIPMENT THAT WORKS' AD, PAGE 52.

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CALENDAR

**New York Wine Industry
Annual Workshop**

April 2-4, Wednesday-Friday

Ramada Inn, Geneva, NY

FOCUS: Red winemaking — Color stabilization, addition of tannins, filtration; Wine microbiology — Biogenic amines, interaction of yeast/bacteria, sanitation; Atypical aging — Description, causes, measures, research update. Trade show and thirteen exhibitor seminars; and wine aromas / tasting seminars.

For program details: www.nysaes.cornell.edu/fst/faculty/henick/wiw/index.html

For more information, contact: Nancy Long (npl1@cornell.edu, ph: 315-787-2288; fax: 315-787-2284); trade show information: Hans Justrich (hj47@cornell.edu, phone: 315-787-2263; fax: 315-787-2284).

World Wine Market 2003

May 1-3, Thursday-Saturday

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More information at: www.world-wine-market.com; tel: 415-383-1226.

**American Society for Enology & Viticulture
Annual Meeting**

June 17-20, Tuesday-Friday

Reno Hilton, Reno, NV

Includes: Warm climate grapegrowing & winemaking symposium, June 17; Two enology sessions: Yeast fermentation biology, Effects of viticultural practices on wine composition quality; Two viticulture sessions: Progress on viticultural diseases, and Sustainable viticulture.

More information at: www.asev.org; tel: 530-753-3142.

**American Society for Enology & Viticulture
Eastern Section Annual Meeting**

July 8-11, Tuesday-Friday

Radisson Hotel Corning, Corning, NY

Includes "Wine Closures: Put a Cork in it?" Symposium with confirmed speakers: Terry Acree, Cornell University, NY; Bark Bassel, APM; Bob Fithian, Cork Quality Council; Leigh Francis, Australian Wine Research Institute; Ken Fugelsang, Fresno State University; Jürg Gafner, Swiss Federal Research Station for Viticulture & Enology; Wolf-Rüdiger Sponholz, Geinsenheim Research Institute; Chris Stamp, Lakewood Vineyards, NY.

More information at: www.nysaes.cornell.edu/fst/asev; tel: 765-494-6704.

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Encyclopedia of GRAPES

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Emile Peynaud 391pp—\$79.00

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M.R. Dharmadhikari, K.L. Wilker
A practical guide for home winemakers, commercial small-scale producers, and large wineries making small, experimental lots of table wine. 145pp—\$25.00

Refrigeration for Winemakers

Ray White, Ben Adamson, Bryce Rankine
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Quality assurance in vineyards, canopy management and economics, improvement of canopy microclimates, importance of wine-grape canopies, construction of trellis systems. 88pp—\$35.00

The Taste of Wine

Emile Peynaud
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Peter May
Use of rootstocks in Australia including physiology and factors affecting rootstock choice. 62pp—\$19.50

Vineyard Simple

Tom Powers
Provides a clear outline with diagrams and color photos on how to build and maintain your own vineyard. 118pp—\$19.95

Viticulture, Vol. II, Practices in Australia

B.G. Coombe, P.R. Dry
Grapevine propagation, vineyard establishment, pruning, canopy management, irrigation, drainage and soil salinity, soil management and frost control; grapevine nutrition, grape pests, disease, protection. 384pp—\$42.50

Vineyards in the Watershed

Julianne Poirier Locke
Sustainable winegrowing in Napa County including: erosion, water, weeds, soil, wildlife, cover crops, vine health, and organic farming. 181pp—\$15.95

Viticulture & Environment

John Gladstones
Selection of site, variety, and cultural practices. Detailed climatic analysis of Australian and world viticultural areas, evaluation of new viticultural sites and possible changes in the climatic conditions. 310pp—\$45.00

Wine Analysis and Production

B. Zoecklein, K. Fugelsang, B. Gump, F. Nury
A practical understanding of quick screening assays, wet chemical and instrument analysis plus results and interpretation of winemaking. 512pp—\$89.95

Wine Growers Guide

Philip Wagner
Easy to understand essentials to establish a vineyard, pruning, training, vineyard management, propagating vines, and vine ailments. 240pp—\$19.95

Wine Microbiology

Kenneth Fugelsang
Provides background information, step-by-step laboratory procedures, and interpretation of results. 245pp—\$79.95

Winery Utilities Planning, Design, and Operation

David Storm
Describes each of the major components of winery utility systems for planning, design, and operation. 550pp—\$99.00

Winery Wastewater Handbook: Production, Impacts, and Management

Jeanette Chapman, Phillip Baker, Sabina Wills
Examines the chemical nature of wastewater, its impacts, how it can be handled efficiently, and disposed of responsibly. 128pp—\$21.00

VARIETAL REVIEW

Mourvèdre

Continued from page 64

pumpovers where the wine is splashed into a screened sump to oxygenate the yeast. Pressing is done to taste after eight to 12 days of skin contact.

"We experimented with different fermentation temperatures and varying length of time on the skins in the 2002 harvest," reports Tsegeletos. "At 85°F maximum temperature and six days of active fermentation, we ended up with the deepest color and best mouthfeel."

Following a pre-fermentation maceration of 24 hours in 5-ton, open-top, wooden fermentors, Staley inoculates the tanks and begins a regimen of three punchdowns per day after a slow starting fermentation (because of the large percentage of whole berries). Once or twice daily early on, the must is pumped into a tank and cooled down, then returned to the fermentor. The wine is pressed as soon as dryness is attained.

Cohn offers yeast a cocktail of Fermaid, DAP, Cerevit, and GoFerm. "We also add Colorpro to extract color and the tannins stabilize the color," notes Cohn. "We were told, that Cerevit in the mix would help prevent H₂S problems and it did."

Killian adds, "Grapes at high sugars and ripeness offer challenges for the yeast. We analyze for free ammonia and add DAP to bump the ammonia to 200 ppm (typically that addition is 4 lb/1000 gal) and add 2 lb/1000 gal of Yeastex."

Staley adds 200 ppm DAP routinely. In 2001, he began adding Red Star Superfood at 150 ppm. "It's cheap and simple," he reports. "For improved color extraction, I also add Lallezyme-Ex."

At Cline, analysis for a target nitrogen is made routinely. DAP is added to achieve the desired level. In years like 1997 and 2000, when many wineries experienced stuck fermentations, DAP was considered an essential aid.

For Cohn, fermentation temperature in jacketed tanks is an important issue. He believes that a wine gains more of the bright, prettier colors and flavors at lower (85°F) fermentation temperatures and darker ones at higher (91°F) temperatures. Choices impact style.

Among participants, maximum juice temperatures range from 80° to 91°F when measured mid-tank after a punch-down. Killian opts for a maximum of 80°F to lengthen fermentation.

Post-fermentation maceration and MLF

At Rosenblum, pressing is done when the sugar level is between 1° and 2° Brix. "This practice retains the bright fruit qualities desired in the wine," Cohn maintains. "We've learned that by doing a pre-fermentation maceration, we no longer need an extended maceration after fermentation to achieve softer tannins."

"Pressed wine is transferred to a tank and the ML culture is added. After settling for two to three days, the wine is racked directly to barrel to complete MLF. We believe this method produces a rounder wine that's better integrated with oak and has improved mouthfeel."

At the end, if the fermentation was strong and steady, Staley inoculates for MLF then presses the wine immediately at dryness. "But," he remarks, "I use a high percentage of whole berries and clusters so the wine is at 2° Brix after pressing." Pressed wine is settled for 24 hours before being transferred to barrel.

Once the wine is at 0° Brix, Killian chooses to press. Following this, the wine is analyzed for sugar, which generally measures about 1%. When near dryness is attained, after approximately five days longer in tank, a ML culture or 1% Zinfandel, that is already undergoing MLF, is added. MLF completes in tank before being transferred to barrel.

"Because the wine contains a high percentage of alcohol," Killian notes, "it's important to choose a ML bacteria that is alcohol-tolerant or use a small percentage of another high-alcohol wine that is going through MLF. Adding dry inoculum to a 15% alcohol wine is a big shock."

For high alcohol reds, participants prefer X-3 ML culture from Scott Labs. Staley suggests Provino, a three-strain freeze-dried culture.

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With respect to completing MLF in barrel, Killian believes that the theory of integration with wood components from the barrel depends on whether the cooperage is new or not. If barrels are older, he doesn't believe there is significant difference between completing MLF in tank or barrel.

Cooperage choices

Among participants, the decision to use American oak (AO) or French oak (FO) varies.

"French barrels," Cohn says, "offer wine finesse while AO contributes opulence. Therefore, I believe in using a blend of both because they complement each other. It's not just FO and AO, it's the cooper, and after barrel experiments over the past six years, we use up to 40 different coopers for our programs. Our attempt is to match specific cooperage with certain programs. That's a bigger picture than whether a winery uses AO, FO, or a mix of both."

Killian prefers FO from two coopers — Nadalié, for its brown spice qualities, and Radoux, for its vanilla character. "Whether a winemaker chooses FO or AO impacts the overall wine significantly," he contends. "That's where preferred style comes in."

Blending varietals

Cline and Preston produce a 100% varietal Mourvèdre.

"Chateau Souverain's Mourvèdre lacked color depth," Killian admits. "To enhance it, we chose Petite Sirah, which also fleshes out the tannins. Our Mourvèdre has naturally soft and round tannins, but in some years it doesn't, so the Petite Sirah helps and fills holes in the wine."

Rosenblum blends with either Petite Sirah or Syrah. Staley's choice is Grenache.

Last drop

Vintage 2001 witnessed Rosenblum's greater emphasis on Mour-

vèdre. The preference had been short barrel ageing, but placing greater importance on the variety created a better understanding of it. Therefore, the decision was made that for vintage 2002, the wine will spend a longer time in barrel.

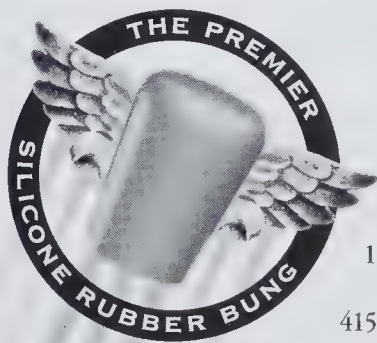
"I don't know," Cohn maintains, "how well our Mourvèdre is going to age. I do know that I've had some 20- and 25-year-old Bandol wines that aged incredibly well. Such tastings inspire us to craft a more ageable wine, yet one that is enjoyable when young."

Cline Cellars made its first varietal Mourvèdre in 1987, and it continues to showcase significant varietal character.

"Certainly," Killian concludes, "Mourvèdre has a reputation for good ageing and offers all producers today the opportunity to understand the variety better in the location where they grow it." ■

PWV thanks Chateau Souverain for hosting the discussion/tasting.

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The mother of all scorecards

During a visit to Sonoma County (CA) in May 2002, I was shown several vineyard scorecards that were being used by wineries to help growers improve grape quality. I was interested to see points of similarity between them, which I believe can be traced back to the scorecard I presented in *Sunlight into Wine*, the book I wrote with Mike Robinson.

I want to review how vineyard scorecards were developed, the ideas behind them, and how useful they can be in managing vineyards to improve quality.

The beginnings...

I first picked up on the idea of a vineyard scorecard after becoming familiar with wine scorecards. They are useful for making subjective assessments of wine quality by scoring individual components, such as color, bouquet, and palate. One of the first developed was the UCD 20-point card. Wine scorecards have now been modified by wine commentators for commercial reasons.

The second and perhaps most important scorecard lead came during a six-month study period in Bordeaux in 1970. There, working with Dr. Alain Carbonneau, I made a study of some of the famous vineyards of the Graves regions. These vineyards were classified from Premier Grand Cru to unclassified, so they included the total range of vineyard quality.

We aimed to see if there was a systematic difference in canopy micro-climate that might be associated with these vineyards. And yes, there was! The vineyards with a reputation for high quality had more open canopies, which was no surprise to Carbonneau and me.

But what was also interesting in this study was the realization that one could **observe** differences between these vineyards that were associated with the difference in canopy structure.

For example, the more open canopies had smaller leaves and shorter lateral shoots. Canes were also thinner, and internodes were of shorter length. Fruit exposure was also higher. Another obvious feature was that the high quality vineyards went into veraison earlier, and the lower quality ones later. This was not related to crop level but was associated with a moderate water stress. Both fruit and canes changed color from green to brown earlier (periderm formation), and the change progressed more quickly.

Development of early scorecards

The thought came to me that these characters, which were so obvious in the vineyard, could be incorporated into a scorecard, and so the *potential for a vineyard to produce quality winegrapes could be assessed*.

There are, however, a few catches. Not all characters are easy to assess, some are much more subjective than others. If we have eight characters, do we know that they are all of equal importance? Likely they are not, but generally, we do not have the information to tell us which characters are more important than others.

Vineyard Scorecard

(from *Sunlight into Wine*)

	Points
1. Canopy gaps	
about 40%	10
about 50% or more	8
about 30%	6
about 20%	4
about 10% or less	0
2. Leaf size	
slightly small	10
average	8
slightly large	6
very large	2
very small	2
3. Leaf color	
leaves green, healthy, slightly dull and pale ..	10
leaves dark green, shiny, healthy	6
leaves yellowish green, healthy	6
leaves with mild nutrient deficiency symptoms	6
unhealthy leaves, with marked necrosis or chlorosis	2
4. Canopy density (mean leaf layer number)	
about 1 or less	10
about 1.5	8
about 2	4
more than 2	2
5. Fruit exposure	
about 60% or more exposed	10
about 50%	8
about 40%	6
about 30%	4
about 20% or less	2
6. Shoot length	
about 10-20 nodes	10
about 8-10 nodes	6
about 20-25 nodes	6
less than about 8 nodes	2
more than about 30 nodes	2
7. Lateral growth	
limited or zero lateral growth	10
moderate vigor, lateral growth	6
very vigorous growth	2
8. Growing tips	
about 5% or less	10
about 10%	8
about 20%	6
about 30%	4
about 40%	2
about 50% or more	0

TOTAL SCORE (Excellent=80)

SMART VITICULTURE

I first used this approach in a study with Syrah in Australia. I used eight characters, each worth 5 points, to assess canopies in a trellis trial, between veraison and harvest. The eight characters were: canopy density, gap presence, fruit exposure, shoot length, periderm extent, lateral growth, shoot growth, and leaf size.

The most open canopy scored 33 points out of 40, and the most shaded scored only 22. So we were able to differentiate between canopies of different density with the scorecard. This was confirmed with light measurements. In this study, cane periderm development was more difficult to assess, because it was variable and difficult to make a judgement about.

But the canopy assessment did correlate with canopy micro-climate measures and also with wine quality, which was assessed by chemical composition and sensory evaluation. This encouraged us to proceed.

I worked more with developing the scorecard in New Zealand, also using eight characters. Three of these characters describe canopy micro-climate (canopy gaps, canopy density, and fruit exposure), while five describe prior growth or physiological status (leaf size, leaf color, shoot length, lateral growth, and growing tips).

In one experiment I assessed how easy it was for judges to make their assessment and how reliable they were. Judges varied from being experienced to novices, and some training was provided.

In general, the judges were quite effective, and the novice judges correlated well with more experienced ones. Statistical analysis indicated that the judges' scores could be averaged safely. Some characters that are more subjective, such as leaf size and leaf color, were handled well by different judges.

Present scorecards

The version of the scorecard in *Sunlight into Wine* has eight characters, each valued at 10 points, totalling 80. It is stated that this is unlikely to be the final form of the scorecard, as other characters might be added and some of the criteria adjusted. For each character to be assessed, there are three to six categories to consider, each associated with a point score. It is important that each of these categories is easy to assess and that the point difference between them is meaningful.

Probably there is no "universal scorecard," as there may be subtle variations to allow for when considering different varieties and regions. For example, in any future version of the scorecard to be used in warm to hot regions, I would consider fruit exposure to the west differently than exposure to other quarters. This would help differentiate between the beneficial impacts of sunlight on grape bunches and the negative effects of too much heat. I would also, in some circumstances, make allowances for water-stress effects.

It takes only about two minutes to assess a canopy. *Sunlight into Wine* provides detailed instructions about how scoring should be performed. It is important to train new judges in joint sessions with plenty of discussion.

Scores and how to interpret them

When a vine is in balance (not too vigorous) and it has an open canopy, its score will be 75 or more out of 80. A dense canopy with shoots of low to moderate vigor will score about



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50 points, and a dense canopy on a very vigorous vine will score around 20 points.

I suggest that scoring be carried out on the same groups of vines each year. The results can be used as a management guide, and the grower can determine which aspects of management may need to be changed to improve the score. Similarly, the scorecard can be used by winery personnel to assess potential wine quality of the vineyard block. This can help winemakers plan fruit "streaming," so similar lots of fruit can be harvested and fermented together. It is an example of "blending in the field."

I think that scoring is best used in conjunction with monitor vines, where pruning weights and harvest weights are recorded. This procedure is also discussed in *Sunlight into Wine*. Together the two practices provide a very sensible basis for vineyard quality assurance. ■

Dr. Richard Smart, "the flying vine-doctor," is an international viticultural consultant based in Australia. He is also a visiting professor of viticulture at Cal Poly, San Luis Obispo, CA. Contact him by e-mail: vinedoctor@compuserve.com. Read about Dr. Smart's business, including his consulting schedule, educational wine tours, and seminars, at his home page, www.smartvit.com.au. He visits America frequently and his consulting schedule is arranged by Vinquiry in Windsor, CA, tel: 707/838-6312 and www.vinquiry.com



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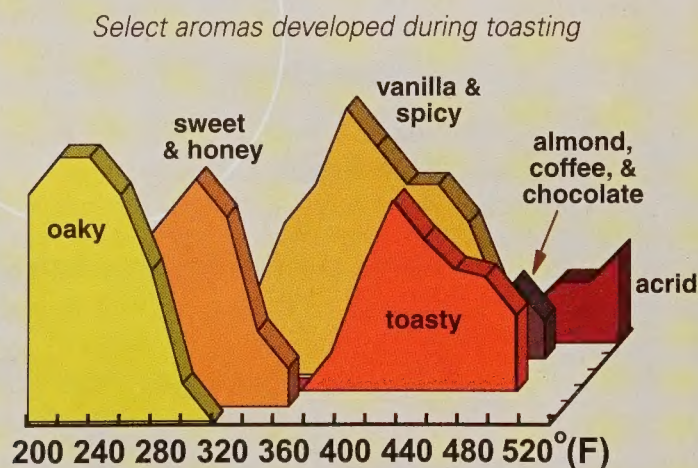
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